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ASTRONOMY.

COMING ASTRONOMICAL EVENTS.

BY EDGAR L. LARKIN, NEW WINDSOR OBSERVATORY, ILLINOIS.

Within a year, newspapers have published sensational accounts relating to impending evil, and have spread the delusion that calamities were about to fall on man, owing to the configuration of the planets. A spirit of astrology seems to have arisen even in the midst of the light of science, and late astrologers have endeavored to fill the public mind with needless fear. Wars, famine, pestilence, earthquakes, deluges and hurricanes, so say the prophets, are to be of common occurrence during the years 1881–82 The planets will become portentous, will assume ominous positions, while the Earth, wandering in space alone, will be under malign influences, making millions die. The critical period is set for June 19th, 1881, when more planets will be on the same straight line with the Earth, than has occurred during centuries of time.

It cannot be denied that on the day mentioned, the bodies forming the the solar system will be arranged in unusual positions. All the power of the attraction of gravitation existing in the system will be exerted against the earth, and the combined force will have *tendency* to draw it nearer the sun.

If, on June 19th, a line be drawn from the first point in Aries, through the center of the Sun, to the first of Libra, the solar system will be divided into two equal parts, when Mercury, Mars, Jupiter, Saturn, Uranus and Neptune will be on one side, with only the Earth, Moon and Venus on the other. Venus and the Moon will

have more effect against the Earth than if actually on the opposite side of the line, because nearer, they will attract with greater power, and the direction of their attraction will be the same as that of the Sun and all the planets.

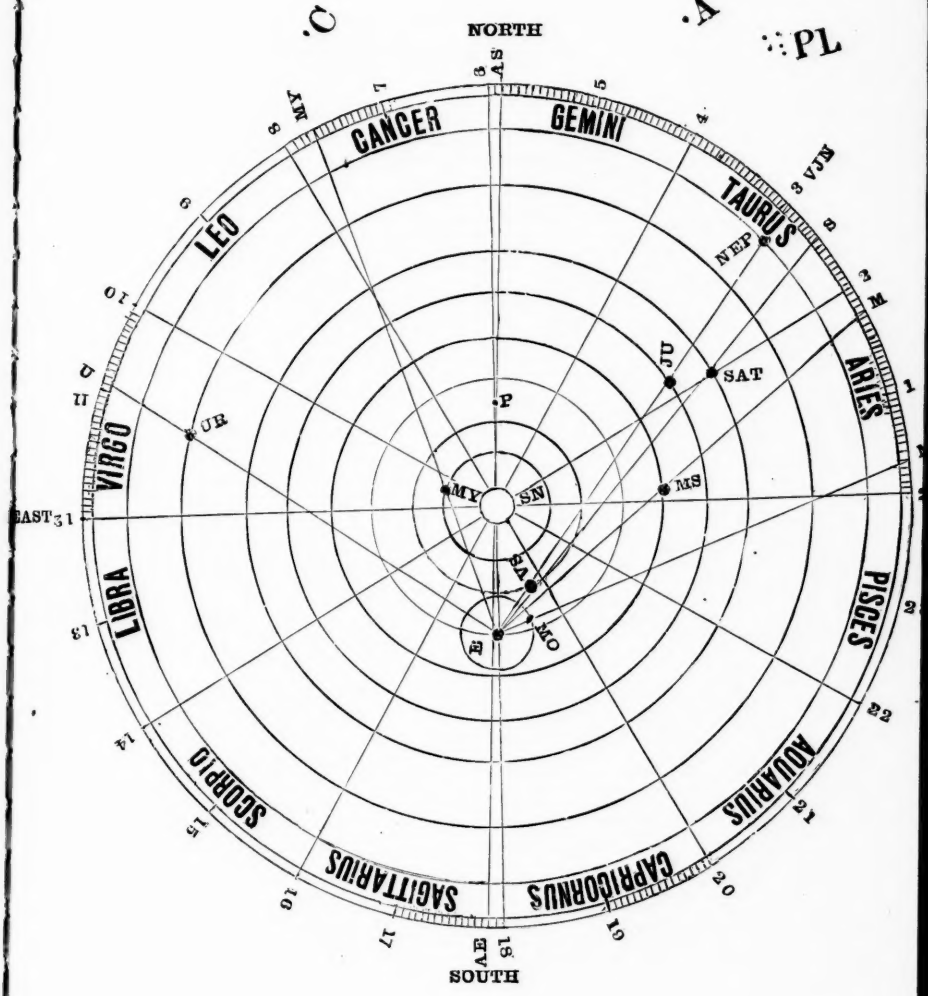
True, our little world, an atom in the Universe, will whirl in lonely voids, with no planet near to aid her against the united power. Our home will be literally isolated in space, and all the forces of nature are now conspiring for a grand opposing effort on the day before the summer solstice. The effect on the Earth will be the same, nearly, as though the Sun on that day should be made heavier by the addition of a weight equal to that of all the planets and satellites. In this note the influence of the Asteroids will be ignored, as their masses are too small to effect any conclusion that may be made.

To make the matter plain, we have drawn up a diagram of the solar system as it will appear on the day in question. For want of astronomical type and characters, we have substituted initials:

SOLAR SYSTEM, JUNE 19th, 1881.

SN.—Real place of the sun.
AS.—Apparent place of the Sun among the fixed stars, as seen from the Earth.
My.—Real place of Mercury.
MY.—Apparent place of Mercury as seen from the Earth.
VS.—Real place of Venus.
V.—Apparent place of Venus as seen from the Earth.
E.—Real place of the Earth.
AE.—Apparent place of the Earth as seen from the Sun, or in heliocentric longitude 268° 30′.
MO.—Real place of the Moon.
MOO.—Apparent place of the Moon among the stars as seen from the Earth.
MS.—Real place of Mars.
M.—Apparent place of Mars among the stars, as seen from the Earth.
JU.—Real place of Jupiter.
J.—Apparent place of Jupiter among the stars, as seen from the Earth.
SAT.—Real place of Saturn.
S.—Apparent place of Saturn among the stars, as seen from the Earth.
UR —Real place of Uranus.
U.—Apparent place of Uranus among the stars, as seen from the Earth.
NEP.—Real place of Neptune.
N.—Apparent place of Neptune among the stars, as seen from the Earth.
P.—North pole of the heavens, or axis of the Earth produced.
PL.—The Pleiades.
A.—The star Aldebaran.
C.—The star Castor.

The outside circle ruled to degrees, and divided into twelve portions, is the concave surface of the celestial vault, or that part of it called the Zodiac. The printed page of the REVIEW is the plane of the ecliptic, or the plane of the Earth's orbit extended to infinity. The Zodiac is 16° wide, hence the reader must imagine 8° below and 8° above the surface of the paper. The twelve signs read all the way round, beginning at Aries, and reading from west to east. All the interior circles are the orbits of the planets. It will be understood that the orbits


NORTH
SOUTH
EAST
AS
MC
DS
IC
GEMINI
TAURUS
ARIES
PISCES
AQUARIUS
CAPRICORNUS
SAGITTARIUS
SCORPIO
LIBRA
VIRGO
LEO
CANCER
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JU
SAT
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are not in proportion, that of Neptune would be far beyond the limits of the page; but the positions of all the bodies are correct. To those who do not make astronomy a study, we suggest that they face south, and lay the REVIEW flat on a table. The north point of the engraving will be toward the south. Place a watch on the Sun, with the 12th hour directed toward the word North, when it will be seen that the motion of all the planets is in a direction opposite to the movement of the hands. Since the page is the plane of the ecliptic, the north pole of the Earth's orbit must be perpendicular to it. The post of the watch is then the axis of the ecliptic. Attach a key, reverse the hands, and the motion of the solar system will be represented. Call the post a pencil long enough to reach the ceiling, it would mark a point thereon directly over the center of the Sun in the cut, and the line will be the axis of the ecliptic, and the point its pole. Call the axis of the Earth another long pencil, then it would make a mark on the ceiling represented in the cut by the point at P. This is the north pole of the equinoctial or Earth's equator extended infinitely. The two points on the ceiling are 23½° apart. Imagine the pencils extended to the celestial vault, and we can learn where the poles are located in space. The pole of the equinoctial is in north declination, 88° and 40′, only 1° and 20′ from the star Polaris; of course it has no right ascension. The pole of the ecliptic is in Draco, dec. north 66° 30′ and always in R. A. 18 hours. In the cut the axis of the Earth, prolonged, cuts the celestial dome at P. This is because the Earth's axis always leans towards the first degree of Cancer, or in the direction of the figure 6, throughout every revolution around the sun.

On the day of the summer solstice, in order for the pole to incline towards the first of Cancer, it passes over the Sun, as may be seen by inspection. In space there are no such directions as north, south, east, west, up, down or over. These terms are used relatively to the Earth, and in treating of infinite voids all such ideas must be dispelled from the mind. When the poles of planes are inclined, the planes must be inclined in exact proportion. As the pole of the Earth leans 23° 30′ from the pole of the ecliptic, so these planes are inclined by the same amount. Since, in the cut, the point P. is inclined from the point SN., towards the north or the top of the book, and as the paper is the ecliptic, the plane of the equator must be depressed below the page, toward the top of the REVIEW, and elevated above it, in that part of the page nearest the reader, in amount equal to the distance between P. and SN. A tangent to the orbit of the Earth may be imagined to be drawn from the number 13 in Libra to 23 in Pisces, passing through the Earth's center. This may be taken, without sensible error, to represent the line of the Earth's equator. Revolve it about the center of the Earth as a center, and it will generate a plane in infinite space. This is the plane of the equinoctial. As this is at right angles to the axis of the Earth, and as this plane points towards P., the plane is depressed below and elevated above the paper, along the line from Pisces to Libra, as above indicated. Then, on the 19th of June, the entire solar system will be in north declination, the Sun and all the planets being north of the equator of the Earth.

Here are the declinations taken from the United States Almanac, every one being north; Sun, 23° 26′; Moon, 7°; Mercury, 22° 9′; Venus, 13° 24′; Mars, 9° 37′; Jupiter, 15° 37′; Saturn, 12° 19′; Uranus, 8° 28′; Neptune, 14° 52′.

But this is no cause why astrologers should seek to create alarm. It is true that when all the planets are on one side of the equator, they will exert an influence to lessen the angle between the ecliptic and equinoctial, or, in other words, draw P. nearer to SN. The equatorial diameter of the Earth is 26 miles greater than the polar; this makes the equatorial protuberance 13 miles high all around the Earth. There is more matter to be attracted about the equator than at the poles. The excess of attraction from the Sun would, in time, make P. and SN., or the ecliptic and equator, coincide, were it not that the earth spins on its axis. The force generated by axial rotation counteracts the attraction on the bulging equatorial region, thus giving stability to the direction of the Earth's axis and plane of the equator. This is called the persistency of the plane of rotation, and may be studied by anybody who has a perfect gyroscope. But the force evolved by the axial rotation of the Earth is not exactly sufficient to overcome the excess of attraction. The two planes do tend to approach, but instead of doing so, the equinoctial slides around on the ecliptic from east to west, contrary to the order of the signs.

The amount of this retrogradation is 50″ annually, and has amounted, since its discovery by the Greeks 2,000 years ago, to a whole sign. Everybody knows that the star Castor is in Gemini, but in the cut it appears in Cancer, its true position in reference to the signs. The stars in Gemini occupy the sign Cancer, those of Cancer the sign Leo, and so on around the heavens. In the summer, therefore, of 1881, all the bodies in the solar system will join in the endeavor to make the ecliptic and equator coincide. This would, in time, put an end to the changes of the seasons; give to all places equal in latitude a climate that would remain invariable, and would doubtless destroy multitudes of the human species.

Astrologers who have not grasped the full meaning of the laws of gravitation and motion, fill the papers with ominous prophecies of approaching danger.

There is not the slightest cause for alarm; all that the planets can do, no matter where they are in their orbits, is to cause a minute increase in precession, so far as their declinations are concerned. This we have seen is 50″ annually, an arc so small as to require mathematical instruments to measure it. The total augmentation of precession the planets are able to cause, is less than $\frac{1}{745}$ of 50″, provided they maintain their united effort throughout the year! But they cannot be in combination longer than the length of the day—the 19th of June. True, they will be in north declination longer, but their directions will be so changed, that by resolution and composition of forces, they will have less than their maximum attraction on the equatorial elevation of the Earth. Their maximum power acting during a year would be less than the small amount mentioned, a displacement of the equinoxes so minute as to be incapable of measurement.

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So much for the troubles to be caused by planetary declinations; now for the woes to be brought about by their right ascensions. "Achilles' wrath to Greece," was not more prolific of tribulations than are to be the aspects of the planets in June. They are to congregate in the same part of the heavens, and start up a tidal wave, magnetic or electric, that shall surge against the earth and make the nations mourn. If the reader should journey into space in the direction of the pole of the ecliptic on the fated day, far enough to look back and secure a good view of the revolution of all the planets, the "collocation of the spheres" would appear as laid down in the engraving. Sure enough the earth is seen wandering alone, away out in heliocentric longitude 268° 30′, and no helping orb is near. Venus, Jupiter and Neptune are precisely on the same straight line with the Earth, all centered in the fourteenth degree of Taurus; Saturn, Mars, and the Moon, are nearly in the same direction; Venus and Saturn are quite near the same right line, while Mercury and Uranus are east of the Sun; but, all save the Earth, Venus, and the Moon, are north of the line running from Aries to Libra,—the Equinoctial Colure. The line running from Cancer to Capricornus is the Solstitial Colure, across which the Earth will pass the next day after the eventful June 19th, when the Earth will enter the sign Capricornus, and the Sun, Cancer.

The Solstice occurs on June 20th, at fourteen hours. As astronomical time begins when the mean Sun is on the meridian, fourteen hours, June 20th, is equal to 2 o'clock a. m., June 21st, at which time to the observer in space, the pole of the Earth's equator, the pole of its orbit, and the first point in Cancer will be on a line as can be seen in the diagram. Thence it is to be observed that the cut is arranged for noon, June 19th, Kansas City time. The north pole of the Earth is leaning toward the Sun; the Moon is setting, and Uranus has already advanced above the eastern horizon. The figures outside the Zodiac beginning at 1, 2, 3, and counting from west to east to 24, or no hours, are hours of right ascension, which is the same as saying the angular distance of a celestial body from the first of Aries, measured on the equinoctial. Each sign is equal to two hours of time, each hour to 15° of space, or sixty minutes, so that each of the degree spaces is equal to four minutes of time. The straight lines drawn from the Earth through all the planets, and produced to the celestial vault, are drawn simply that the reader may learn where they will appear to be as seen from the Earth; and that he may know that the right ascensions are correct. Here are the right ascensions of the planets on the direful day.

Sun, 5 hours 53 minutes; Moon, 15 m.; Mercury, 7 h. 42 m.; Venus, 2 h. 55 m.; the Earth,—longitude 268° 30′; Mars, R. A., 1 h. 48 m.; Jupiter, 2 h. 54 m.; Saturn, 2 h. 29 m., Uranus, 10 h. 48 m.; and Neptune, 2 h. 54 m. It will be seen that the R. A. of Venus is 2 h. 55 m.; Jupiter, 2 h. 54 m.; and Neptune 2 h. 54 m., only one minute difference. So we draw a straight line from the Earth through all of them. The law of gravity is this:—

"Every particle of matter in the Universe, attracts every other, directly as to mass, but inversely as to their distance squared."—Newton.

The joint attraction of the whole solar system, acting on the Earth is to draw P. to SN., which has been shown under the head of declinations to be inappreciable. The combined power of the Moon, Venus, Mars, Jupiter, Saturn and Neptune, will aid the Sun in its attempt to draw the Earth nearer to its mighty mass. But these same planets at the *same* time, tend to accelerate the orbital velocity of the Earth. Hence our world will not be affected at all. It can neither fall nearer the Sun, nor move faster. The astrologers make no account of inertia, inherent in the Earth and all matter. The planets help the Sun attract the Earth, and help the Earth to resist it in equal proportions. Increased velocity enables inertia to re-assert its powers, and appear as a force called the centrifugal. Since the same bodies that cause the attraction also cause the opposing force, both must be equal, and we shall continue our flight through space as though nothing had happened.

The student of physics, gravity, motion and geometry, knows that any number of forces are capable of resolution in the direction of diagonals, of parallelograms, rectangles, parallelopipedons and similar geometrical figures. He can take the cut and draw up a series of such figures by the rules of resolution and composition of forces, in relation to the Sun, the Earth and any planet, and in doing so will find that all the planets aid the Sun by increasing its attraction on the Earth. This is as it should be, because the Sun is the center of gravity of the system. Now draw similar figures relative to the Earth, and its motion in relation to the Sun, and the diagonals of the whole series of drawings will be in equivalent ratio; hence, the Earth will not be disturbed on that awful day.

Uranus and Mercury serve to retard the Earth, thereby enabling the Sun to attract with greater effect. Therefore their action may be called the residual of force remaining in the entire solar system that is at liberty to effect the Earth. As the forces of all the planets west of the Solstitial Colure, and therefore west and north of the Earth, are neutralized, the feeble attraction of Uranus and Mercury alone remains to cause wars and plagues. And the perturbation of the Earth from the action of these planets will be so slight as almost incapable of detection by accurate astronomical instruments. Really the Earth is not in such a dangerous position as it was on Oct. 7th, 1880, when Jupiter was in opposition. October 7th was a fine day. The Earth in June will be near its aphelion; and acceleration would not bring calamity; even if in perihelion, it should suffer increase of velocity, we should be in no danger. Equal areas are described by the radius vector in equal times; the laws of nature are invariable, and all perturbations are corrected. If all the planets in the system were on a straight line with the Sun and opposed to the Earth; or, if they were all placed on the Sun, the attraction of the solar mass would be increased by less than the $\frac{1}{745}$ part. The mass of the Sun is 745 times greater than the combined masses of all the planets and satellites. Take a stone weighing 746 pounds, break off one pound and the ratio will be that of the Sun and planets. Any force whatever the planets are able to lend the Sun as against the Earth, is *less* than $\frac{1}{745}$, because

the mass of the Earth itself is included in the pound broken from the original weight. Will the Sun that sustains our lives be malignant on June 19th? Because several planets are on line will the chemical constituents of the terrestrial atmosphere be changed to cause pestilence? How can planets cause storms on the earth, or earthquakes? Even the tides will be no higher on that inauspicious day than usual; how then can the crust of the Earth be moved? And what politicians are making ready to precipitate a war in mid-summer because Venus, Jupiter and Neptune are now exerting influence upon them? What modes of force reach the earth from the planets? There are known to be two,—gravity and light. The spectroscope shows that their light consists of reflected solar rays. They are globes something like the Earth. What malignant power leaves the Earth to produce destruction on Jupiter? Does magnetism reach us from the planets? When terrific storms rage in the Sun, it requires a sensitive magnetograph to detect the magnetic influence reaching our world; the telegraphic instruments are effected, and in the evening we are favored with a harmless auroral display. Should all the planets aid the Sun in generating a magnetic disturbance on the Earth, their assistance would be less than $\frac{1}{743}$ of its intensity. Anybody can become an astrologer on an hour's notice. All that is necessary is to procure the U. S. Nautical Almanac, look along the columns of right ascensions, until two planets are found to have the same, and predict a storm, war, or famine for the date. Then if it rains at Cape Horn, or the Turks and Russians fight, the prophecy is fulfilled. On September 25th, 1880, Jupiter was in perihelion, and in opposition a few days later, on October 7th, while Saturn was in nearly the same direction. Jupiter was at its nearest possible point to the Earth, and our little world was in direct line of malignant influence. Yet the weather was excellent, the air fine, and well suited for telescopic work. At the most dangerous period we were engaged for hours in making close examination with high magnifying powers, of every portion of its disc, to see if any changes were wrought on Jupiter by its approach to the Sun and Earth. We saw none take place while looking, but on the following night detected several that had occurred during the interval, all minute, however. But there are instances recorded where movements have been seen to take place in a few hours; therefore, the attraction of the Sun produced no marked change on Jupiter during its last perihelion, though aided by the Earth. We conclude that planetary convulsions arise from forces inherent in themselves, and not from attraction or electricity from the Sun. And then, how can electricity produce vortices in the atmosphere of the planets, when it has to traverse a non-conducting vacuum to reach them from the solar battery? The Earth has been in trouble before. On February 28th, B. C. 2446, the Earth, Moon, Mercury, Mars, Jupiter and Saturn, were all in line in Pisces, as is recorded in Chinese annals. M. M. Desvignoles and Kirch made calculations, and found that such conjunction did occur. But the Chinese astronomers made a fatal omission,—they did not tell us whether it rained on that day.

On September 15th, A. D. 1186, the Earth, Mercury, Venus, Mars, Jupiter

and Saturn, were ranged in line in Virgo. If the Earth left its orbit, it managed to find it again. Many similar conjunctions are on record. (See Chamber's Astronomy, pp. 48–49.)

Have the astrologers heard of this eternal law? If the mass of each planet be multiplied by the square of the tangent of the orbit's inclination to a fixed plane, and this product by the square root of the mean distance, the *sum* of the products thus formed will be INVARIABLE."—*La Grange.*

This is the law of the invariable plane; it lies near the orbit of Jupiter, and insures the stability of the solar system. Instead of fearing the planets, we love their solemn influence, and at midnight hold communion with them, while watching the transits, eclipses and revolutions of their satellites. In place of ascribing to them baneful influence on man, we think their contemplation will make men better, and inspire all who study the laws of their motion with exalted sentiment. We see nothing in planetary position on June 19th, or at any other time, to cause man to distrust nature. And we are willing to place full confidence in those admirable laws that are known to rule with rigor every movement of that vast machine, the solar system.

NOTE.—To Students in School just beginning Astronomy: Should it be desired to use this diagram at noon on June 19th, proceed as follows: Lay the Review on a table as before, the north point toward the south. Procure two straight sticks, say one of walnut and the other of pine; lay them on the table side by side, in direction north and south. They will be nearly in the plane of Solstitial Colure —exactly next day. Look on a map and find your latitude. Tie a string to the pine stick, pass the other end of the cord over the hanging lamp, and draw up the end of the stick in degrees equal to the latitude, and make it fast. The stick will be parallel to the Earth's axis, and will be pointing to the pole of the heavens. This is because the altitude of the pole equals the latitude of the place. Elevate the north end of the walnut stick in the same manner, but suspend it $23\frac{1}{2}°$ below the pine stick. It will point to the pole of the ecliptic. It will be noted that the pole of the heavens is between the pole of the ecliptic and the Sun, because the planes are inclined, and because the pole of the Earth leans toward Cancer. Hold the engraving close to the walnut stick, at right angles to it, and the whole solar system in its position at noon, in relation to your own meridian, will be delineated.

MAY 15TH, 1881.

LUNAR ECLIPSE AND OTHER PHENOMENA FOR JUNE, 1881.

BY W. W. ALEXANDER.

Total eclipse of the moon June 11th and 12th, 1881:

	d.	h.	m.	
Moon enters Penumbra, June	11	9.	56.5	Kansas City mean time.
Moon enters shadow	11	10.	52.3	" "
Total eclipse begins	11	11.	54.6	" "
Middle of eclipse	12	00.	35.5	" "

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Total eclipse ends	12	1.	16.4	Kansas City mean time.
Moon leaves shadow	12	2.	18.2	" "
Moon leaves Penumbra	3	3.	13.7	" "

Magnitude of the eclipse, 1.365 (moon's diameter, 1).

This is the first total eclipse of the moon visible at Kansas City during many years past, therefore it is quite proper to briefly describe the cause and appearance of the phenomenon.

Every one familiar with the moon's motion knows that it performs its journey around the earth in nearly 29½ days, and if its path lay in the plane of the ecliptic we would have a total eclipse every month, but this is not the case, as its path is inclined about 5° to that plane, one-half of its journey is performed above it and one below it; hence, at certain times (twice in each revolution) the moon is in that plane, at those parts of it called the nodes. Now if the moon at that time happens to be full, that is, in line with the earth and sun, we shall have a total eclipse of the moon. This happens on the evening of the 11th, so at 9 h. 56.5 m. we shall see the moon's eastern side slightly dim as she enters the penumbra. When the umbra is reached the eastern edge will become almost invisible; the circular shape of the earth's shadow will be then distinctly seen as the moon advances; by 11 h. 54.6 m. it is entirely in the umbra or shade of the earth, but if the night be perfectly clear it will not disappear entirely, owing to a sufficient quantity of the sun's light being reflected by the earth's atmosphere towards it to render it faintly visible, and tinge it with a ruddy color; at 1 h. 16.4 m. this phase ends and the eastern edge will become more illuminated by entering penumbra when the circular shape of the earth's shadow will again be seen, but reversed, *i. e.*: its convex side will be turned east. By 2 h. 18.2 m. it will be out of the umbra, and by 3 h. 13.7 m. the western edge leaves penumbra and the eclipse is over.

POSITION OF THE PLANETS.

Mercury reaches its greatest elongation east from the sun on the 19th, and will be visible in the West for a few days, before and after that date.

Venus, Jupiter and Saturn will form many beautiful and interesting triangles this month. On the morning of the 6th, Venus and Saturn will be within 11° of each other or about one-third the diameter of the moon. Venus will be to the north of Saturn. On the 11th, 12th and 13th they will be nearly equidistant from each other, Venus being about 2° south of a line drawn between Jupiter and Saturn.

On the morning of the 19th, Venus and Jupiter are in conjunction, Venus being south 2° 15′. Neptune is also in conjunction with Jupiter and Venus at the same time being nearly midway between them.

Uranus will be in the constellation Leo in nearly the same position as during the month of May, being favorably situated for evening observers.

CHEMISTRY AND METALLURGY.

CHEMICAL AND DYNAMICAL GEOLOGY.

BY ERASMUS HAWORTH, CLASS OF '81, KANSAS STATE UNIVERSITY.

It is so common for students who are specialists to prepare theses showing the results of original work, that one hesitates to present anything which does not strictly conform to this custom. But time is often quite as profitably spent in learning that which has already been discovered, in comparing the views of different scientists on the great questions which are yet unsettled, and in choosing from these that which seems most reasonable, as in trying to enter new fields of investigation. The investigations which are richest in results are made by those who have a general idea, at least, of all the important facts and theories pertaining to their department. It is easy to see how a young man, ambitious to gain a reputation, may rush into original work before he is able properly to assimilate the truths that may be presented to him. In the following pages, therefore, there will be no attempt to present that which is new, but only to express in a somewhat orderly manner a few thoughts on chemical and dynamical geology as advanced by others. Occasionally I may offer objections to certain hypotheses, or draw conclusions that I think would follow from given conditions.

If we accept the nebular theory we are carried back to a time when the earth with all that now belongs to it was in a gaseous condition. No man can follow with absolute certainty the different phases through which it passed in being brought to its present state. To the chemist and the physicist alone remains the privilege of even attempting to say what must have resulted from the continual radiation of heat from this aggregated gaseous body. Moderate heat generally assists chemical action, but it is well known that an intense heat tends to break up chemical compounds. The furnace assay of gold and silver is based upon this fact. These metals are frequently found in chemical union with other elements. The heat of the furnace overcomes this union, drives off the other elements and leaves the gold and silver. From analogy we reason that the formation of compounds, however stable they may be in the hands of man, would have been prevented by the heat necessary to hold the materials of the earth in a gaseous condition. As this mass cooled by the radiation of heat, the time would come when the most stable compounds could exist. We may safely say that such compounds would then be formed. These would be the oxides of calcium, magnesium, barium, aluminum, iron, copper, silicon, and perhaps the oxides of the alkaline metals. The surface radiation would produce a superficial low temperature, so that some particles might be condensed to the liquid or solid state. They would then become intensely luminous, presenting an appearance similar to

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that of the solar photosphere. Being more dense than the surrounding gases they would sink toward the center. This would bring them again into a great heat which would revolatize them. While this was repeating itself at the surface, the great pressure at the center would tend to liquefy the gases, and afterward to solidify all those liquids which continually contract on cooling. This is an important point, first pointed out by Hopkins who, from mathematical calculations, proved that while the mass was yet gaseous or liquid, the pressure must have been sufficiently great to solidify the center.

We have similar examples almost every day, when the different gases are liquefied or solidified by artificial pressure. So long as this mass remained in the gaseous or liquid state, the heaviest portions would sink deepest from the surface. We may therefore safely conclude that the center of the earth is composed of the heavy metallic oxides, possibly with some of the most refractory metals in the native state. In the course of time the temperature would be sufficiently reduced for the oxides of carbon, sulphur, and hydrogen to exist. These with the haloid elements, nitrogen and perhaps an excess of free oxygen, would remain in the outer portion of the gaseous envelope.

Portions of the water formed would be decomposed by the chlorine, forming chlorhydric acid. Other portions would subsequently unite with sulphuric oxide to form sulphuric acid. When the temperature was sufficiently reduced, a crust would be formed on the outside of the liquid mass, so that solidification would be going on from the inside out and the outside in, with a great mass of liquid matter between. These being the conditions it is easily understood how the solid crust and all beneath it would be perfectly anhydrous, the basic oxides being united with silicic oxide to form innumerable silicates.

It has been argued that the nebular theory could not be true, because, if the elements had ever been free to move among themselves, they would have united with reference to their greatest affinities, so that a sort of chemical stability would have been formed. Such arguments only betray a lack of chemical knowledge. The oxides of the bases together with the oxides of silicon, and perhaps of boron also, would have been formed, as I have tried to explain, under such conditions as to entirely separate them from water and the volatile acids; so that the formation of hydrated salts, of chlorides, bromides, iodides, fluorides, nitrates and sulphates, would have been impossible. In predicting chemical changes one should carefully consider the environment. Temperature and pressure have a wonderful influence. This outer crust of the earth, resting on the liquid beneath, would be affected by contraction resulting from continual cooling, so that it would present a very irregular surface. As soon as the temperature would permit, the watery vapor, charged with the acids until then existing in the air, would be precipitated in enormous floods.

At the present time, when all the rain water must previously be vaporized by the heat of the sun, according to Loomis, a flood of fifteen inches has fallen in six hours. At tbat time, when all the waters of the ocean were held in vapor, the

precipitation must have been immensely greater. In addition to the mechanical erosion, a mighty chemical action must have begun which, assisted by the heat from beneath, probably surpassed anything our fancy can picture. A half bushel of unslaked lime, when treated with the proper amount of water, generates heat enough to set on fire dry wood that may be in contact with it. How great then must have been the chemical action when these liquid acids were first brought in contact with the earth. It has sometimes appeared to me that it would have been impossible for this primitive crust to be so acted upon as to furnish material sufficient for sediments to bury it so deeply that no portion of it can now be found; but this trouble entirely vanished when I considered the immense acid floods that must have fallen on this primitive crust which was already of an irregular contour. The action of the acids would not have ceased until their affinities were satisfied. The chlorine would then mostly exist in the form of chlorides of sodium, calcium and magnesium; the sulphur in the form of sulphates. Sulphides could not then exist, because the sulphur had been oxidized. Great quantities of silica would be left uncombined by these actions, the bases of the silicates having united with the stronger acids. This would furnish quartz for the many sandstone deposits so common in all geologic ages. Soon after rain began to fall the atmosphere would be reduced to about its present condition, with the exception of the large amount of carbon di-oxide that it would contain. In comparison with chlorhydric acid this gas is but slightly soluble in water, and would therefore be removed from the air much more slowly. Perhaps this is a proper place to remark that the question of the source of the carbon and the oxygen of the earth is a very perplexing one to all speculators. We can only conceive that everything was oxidized to the greatest extent in primitive times. Hence the deoxidation caused by the growth of plants and the reduction of sulphates to sulphides would have liberated great quantities of oxygen. So far as we now know, the only ways for oxygen to be removed from the air are the oxidation of organic matter, the change of binary to ternary compounds, and the change of certain "ous" salts to the "ic" condition. But this is only replacing it where it originally belonged, so that it really is removing nothing from the sum total of the oxygen in the air. It has been estimated by different scientists that if the carbonaceous matter now in the earth has been reduced from carbon di-oxide, it must have liberated more than twice the amount of oxygen now in the air. But the amount of pure carbon now in the earth is almost insignificant in comparison with the total in the form of carbonates. Hunt has estimated that if the whole amount of carbon now in the earth were liberated in the form of carbon di-oxide, the gas would equal in weight two hundred times the present atmosphere. The question naturally arises, whence this vast amount of gas? In considering this question Hunt says: "We are thus forced to one of two conclusions: either the wholly improbable one that the atmosphere since the appearance of organic life on the earth has been one of nearly pure carbonic di-oxyd, and of such immense extent that the pressure at the surface would have sufficed at ordinary temperatures, for

its liquefaction; or else, the atmosphere being so constituted as to permit vital processes, that carbonic di-oxyd, as fast as removed by chemical action at the earth's surface, was supplied from some extra-terrestrial source. We may, in accordance with this last hypothesis, admit that the atmosphere is not terrestrial but cosmical, and that the air, together with the water surrounding our globe (whether in a liquid or a vaporous state), belongs to a common elastic medium which, extending throughout the interstellary space, is condensed around attracting bodies in amounts proportional to their mass and temperature, etc." If this view be correct, it would follow that the diffusion of gases would maintain a certain equilibrium between the atmospheres of different centers of attraction throughout space. This view was first advanced by Sir William R. Grove, in 1842, renewed in 1866, and mentioned by many others since. According to this theory our moon should have an atmosphere; but astronomers have failed to detect it. There can be no doubt that carbon di-oxide was much more plentiful in the air in early times than it now is. The wonderful growth of vegetation can only be accounted for in this way. It is also the most probable cause of the warm temperature of early times. Tyndall very beautifully showed that a small addition of this gas to the air would greatly elevate the temperature by preventing the radiation of heat from the earth, just as the "cold frame" does which the gardener uses in early spring. But to return from this digression. As before stated, the action of the acid liquid on the primitive crust would furnish abundant material for sedimentary deposits. Feldspars disintegrated furnish clays. Almost any silicate that would be affected by acid, would furnish sediments. The crust was probably a mechanical mixture to a great extent, so that quantities of it which were unaffected by the acids, were left in a finely divided state. It is difficult to conceive of the waters under such conditions as being at rest. The tossing ocean that was just being formed would have been an ample vehicle for these sediments, so that deposits could have been formed before dry land emerged. We may look mostly to the air and water for causes of the various phenomena since dry land appeared. That organic matter, resulting from both animal and vegetable life, has also played an important part in geological phenomena is now well known.

The ocean waters would hold in solution great quantities of soluble salts, particularly chlorides of sodium, calcium and magnesium, and sulphates of sodium and magnesium. Rain water washes from the air large quantities of carbon di-oxide, free oxygen, some ammonia, also organic impurities which have been reduced to a finely divided state and are held in the air. By coming in contact with decom osing vegetation the water becomes charged with organic matter which soon combines with the free oxygen, forming thereby more carbon di-oxide. This changes the water from an oxidizing to a reducing agent. Sulphides owe their existence to this fact. Some sulphates are reduced directly to sulphides by giving up their oxygen to carbonaceous matter held in solution. Others are reduced in such a manner that sulphydric acid is generated. This being very soluble in water may be carried by it to different places. It is thus brought in con-

tact with metallic salts which are precipitated as sulphides. It is thought that all sulphides owe their origin, directly or indirectly, to the reducing power of organic matter. Water also takes up from decaying vegetation much soluble earthy matter. Carbon di-oxide gives it the property of dissolving limestone and dolomite which it then holds in solution in the form of bi-carbonates. The porosity of rocks permits the water to gradually sink beneath the surface, so that portions of it come in contact with rock and minerals far beneath. The following figures, showing the amount of water by volume and by weight that 100 parts of different rocks will hold, are taken from a table prepared by Hunt:

	Volume.	Weight.
Sandstone—Potsdam, hard and white.	1.39	0.50
Sandstone—Potsdam, with lingula.	9.35	3.96
Sandstone—Medina, red argillaceous	10.06	4.04
Limestone—Trenton, gray crystalline	1.70	0.65
Limestone—Trenton, black, compacted	0.30	0.11
Dolomite—Niagara, gray, crystalline	5.27	2.08
Dolomite—Chazy, argillaceous	13.55	5.55
Dolomite— ———, calciferous	7.22	2.27
Limestone—Tertiary (Caen, France.)	29.49	15.85

Feldspathic rocks, especially soda feldspars, are disintegrated by these waters charged with carbon di-oxide, yielding sodium carbonate and clay. The economy of nature is here nicely illustrated by the fact that the soil takes from the water the salts of potassium and ammonium, which are so necessary for plant life, while it gives sodium in return. Thus the waters that are continually entering the ocean, seas and lakes, contain almost no potassium, but large amounts of sodium in the form of carbonate. In early geologic times, when the air contained much more carbon di-oxide than now, and the earth much more albite and oligoclase—soda feldspars—these actions were probably much more rapid. The first reaction between the sodium carbonate and the salts of the sea water would result in converting the calcium chloride into calcium carbonate, (*limestone*), sodium chloride, (*common salt*), being formed at the same time. This, perhaps, was the origin of nearly all the calcium carbonate the ocean water ever contained. In lakes and inland seas where it would be possible to thus decompose all the calcium chloride, the next action would be the conversion of magnesium chloride into magnesium carbonate, with the further formation of sodium chloride. Much of the calcium would be in the form of bi-carbonate, which would react on any magnesium sulphate present, making calcium sulphate, or gypsum, and magnesium carbonate. In these inland seas, where evaporation was continually going on, the gypsum would soon be deposited. Should the concentration be continued, magnesium carbonate would be thrown down along with great quantities of limestone. If such inland seas could occasionally receive an influx of salt water, as many such seas do at the present day, the precipitations would be repeated. If the concentrations should ever be carried far enough salt would

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also be thrown down. The salt lagoons along the Black Sea, and other similar places, are instances in which the actions above described are to-day carried on before our eyes. It has been proved by actual experiment, that these actions follow such conditions, so that this is no fine-spun theory. It has also been shown that when a solution of calcium sulphate is surrounded by an atmosphere of carbon di-oxide a much less degree of concentration will precipitate the gypsum. This would help to account for the large beds of gypsum found in some places. Some fresh waters contain calcium sulphate and magnesium carbonate which are deposited by evaporation. Also, many waters containing magnesium and calcium sulphates are mixed with river waters containing sodium carbonate, which changes these salts to carbonates, after which they are much more easily deposited than when held in solution by sea water. This, perhaps, is the origin of many magesium limestones and dolomites, which are not associated with gypsum or common salt.

We may safely conclude, then, that the alternate deposits of gypsum, magnesium carbonate and common salt indicate the former existence of inland seas, which have been subject to a considerable concentration. The continued leaching from the soil of so much sodium carbonate, which is afterwards carried to the sea, can only result in making the sea water more salty, and in a corresponding removal of calcium chloride. That such a change is actually taking place, is proved by comparing analyses of ancient and modern sea waters. In the cavities of many rocks may be found water that was enclosed when the rocks were formed. Such waters contain much more calcium chloride than do our modern waters, but much less sodium chloride.

It does not seem possible that all, or nearly all, limestone is organic, as is commonly taught. There are but two ways by which the great amount of calcium carbonate formed in past time—and which is still being formed—can be removed from the water; first, by precipitation and crystallization; second, by being assimilated by organic life. I cannot help believing that the greater part of it has been precipitated. Large proportions of all limestone, no matter how fossiliferous it may be, has once been in a finely divided state. To attribute the origin of these to disintegrated organic remains, is striving too hard for an explanation.

The western part of Kansas abounds in thick beds of limestone and in chalk formations. This limestone is of a fine texture, gradually grading into the chalk beds. In many places are found almost the entire skeletons of fishes, birds and reptiles of different kinds; also in many places ammonites, which are beautifully preserved. These skeletons are sometimes found with almost all their bones in their proper places. Even a large piece of a saurian skin was found, which must have been left quiet for a long time, or it could not have been so perfectly preserved. In short, there is no lack of evidence that the seas of western Kansas were unusually quiet. Yet, these great beds of limestone have been mostly made up of finely divided calcium carbonate. I cannot conceive of a raging and

tossing sea, necessary to grind to powder such vast quantities of shells, without scattering the bones of the fishes, birds and reptiles more than has been done, without leaving indications of wear on the ammonite shells, or without even shaking from its bed that piece of putrefying saurian skin.

In the early days of geological science, almost every one believed that all crystalline rocks and minerals were of igneous origin. In the course of time another school arose, teaching that all crystalline rocks were of sedimentary origin. These are known respectively as the plutonian and neptunian schools. Modern investigations have brought so much support to the neptunists that the leading geologists of to-day hold with them that crystalline rocks are of sedimentary origin. Many deposits originally contained all the elements found in crystalline rocks; many others, long after they were formed, may have had new elements added by infiltrating waters. The degree of porosity, as before shown, is sufficient to permit such to be done. Internal heat is also an important factor in metamorphic changes. The average rise of temperature as we descend below the surface is one degree F. for about sixty feet. In earlier times, when the outside crust was comparatively thin, this increase was much greater. As deposits increased in thickness the isothermal horizons would rise so that the time would come when they would be heated to a high temperature. The conditions would then be favorable for numerous changes in the sediments themselves. Waters containing alkaline carbonates under heat and pressure will soften almost any silicate. Daubrée has shown that the temperature need not exceed 700° F. for quartz, feldspar and pyroxine to be softened sufficiently to assume the crystalline form upon cooling, and also that at this temperature alkaline silicates in solution will unite with clay to form feldspar and mica. He also showed that the alkali springs of Plombières, with a temperature of 160° F., had acted on the bricks and cement of the old Roman baths so as to form zeolites and other silicated minerals. Different geologists, notably, Mr. Sorby, from their study of crystals, have concluded that granitic and trachytic rocks have been formed in the presence of a liquid under great pressure and at a temperature not exceeding that of redness. These semi-fluid masses, under such great pressure as they probably endured, might frequently be forced into crevices and faults in the rocks above them, and thus present the appearance of igenous rocks.

The question of the origin of volcanoes is one intimately connected with metamorphic changes. The old idea that the lava comes from the molten interior of the earth has many facts in its favor. The greatest of these is the vast extent of simultaneous volcanic action in former times. According to Dana, at the close of the Triassico-Jurassic period, an eruption was continuous from Nova Scotia to South Carolina; the lava throughout the whole extent being doloritic. Much more extensive eruptions have taken place on the Pacific slope. If I rightly understand Dana he thinks that these vast eruptions originated in the molten interior. However, he says, that if such be true, it does not follow that all lavas come from the same source.

In opposition to the theory that lavas come from the liquid interior, is a theory supported by many geologists who suppose that the seat of volcanoes is in the deeply buried sediments. The process of metamorphism, which I have attempted to describe, would doubtless generate great quantities of gases. Much of the salt of the sea water contained in the sediments would give up its chlorine to form chlorhydric acid, which is a gas. Large portions of water would be vaporized. Carbon di-oxide would also be given off from many carbonates. These gases would be held by the superimposed strata until the pressure became so great that they would force their way out through fissures in the rocks, forming trap dikes, or through true volcanoes. It is only reasonable to conclude that in so doing they would force great quantities of the liquid sediments before them.

There are many facts which support this theory of volcanoes.

1. The usual escape during eruptions of carbon di-oxide, of chlorhydric and sulphydric acids, all in the form of gases.

2. The fact that the lavas of different volcanoes vary so much in composition; also that the lavas from the same crater vary greatly at different eruptions.

3. Some lavas contain hydrous compounds which, according to the theory of the cooling globe, could not exist in the original molten interior.

4. The theory demands the extensive generation of gases in sediments, while they are comparatively new. As soon as the deposits were thick enough to raise the isothermal horizon, action would begin. In the course of time a sort of chemical stability would be formed, gases would cease to be evolved, and the cause of eruptions would be removed. The facts correspond to this. The Appalachian system, which is the oldest on the continent, has long been free from volcanoes. The much more recently formed Pacific ranges still have a few, while the Oceanic Islands, around which sediments are now being formed, are the scenes of frequent eruptions.

I am inclined to think that this last theory is the proper one to account for all modern volcanoes. Its causes are surely adequate to the effect.

Some idea of the force of gases under pressure may be formed from the numerous examples in the Pennsylvania oil regions, where water was forced to a great height by that means. It is reported that from one well the water and oil were forced to a height of 180 feet. It probably reached from 125 to 150 feet. But this came from a very short distance below the surface in comparison with the thickness of sedimentary deposits.

In early geologic times, when the crust of the earth was much thinner, and the contraction from cooling much more rapid than now, eruptions from the interior would be no great wonder. But at the present time the liquid mass, if existing at all, must be very far beneath the surface. Hopkins has calculated that the minimum distance to the molten interior must be fully 800 miles. Hennessy assigns 600 miles for the maximum thickness of the crust. However this may be, it is very doubtful if anything from beneath the sedimentary deposits is brought up by modern volcanoes.

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The second theory described above does not attribute the heat acquired entirely to chemical action. In fact, this, in many cases, is of such a nature as to absorb heat rather than generate it. Such would be the decomposition of chlorides, sulphates and carbonates by silica. It looks to the great heat in the interior of the earth as one of the important causes.

It has long been known that there is an intimate relation between earthquakes and volcanoes. Earthquakes are a series of terrestrial vibrations which extend from a center as sound waves widen from the place where the air is first set in motion. Now, when the great quantities of gases, which are held under pressure, break through the opening in the rocks, or force new openings if none already exist, great vibrations must follow. This might frequently happen without the escape of gas at the surface, the passage being from one interior cavity to another.

It is counted a sign of an earthquake for an active volcano to cease its flow of lava. This, I think, simply means that whenever the lava stops flowing, something has obstructed the passage of gas from its great reservoir to its outlet, and, before long, pressure becomes so great that it breaks through in the same or in another place.

THE HISTORY OF TIN.

From an interesting paper by E. Reyer, in the Austrian *Zeitschrift für Berg-und Hüttenwesen* (Vol. xxviii., 1880) we gather the following particulars concerning the history of tin. The most ancient names for this metal (Indian, *naga;* Persian, *aonya;* Hebrew, *anak;* Ethiopian, *naak*) indicate that its earliest source was Farther India, from the greater placer deposits of which it was distributed over Asia and eastern Africa. The Mediterranean name, *kassiteros*, used by HOMER, was probably spread by the Phœnicians through their commercial world; and its prevalence from 1000 B. C. indicates the supply of tin through these enterprising traders from Spain and also from Britain. Perhaps they carried the name, though not the article, even to India. At least, it is certain that, in the centuries just preceding the Christian era, the name *kastira* occurs for tin in Indian documents, instead of the more ancient native term.

The bronze manufacture of China, which flourished as early as 1800 B. C., and the equally ancient industry of India, must have required large quantities of tin from the Indian placers.

During the commercial supremacy of the Phœnicians, Cadiz in Spain was the principal metropolis. After the Roman conquest of Spain, the British tin trade took a new route. Cæsar speaks of the *plumbum album* of Britain; and DIODORUS relates that it was found as ore in the rocks, and that the smelted metal was carried in bars to Iktis (the Isle of Wight), thence to Gaul, and through Gaul on horses to the Rhone. Marseilles was the shipping port, and soon assumed for this trade the position formerly held by Cadiz.

At this time, the pure metal was used for tinning copper (at which Pliny says the Gauls were very skillful), for making vessels, and occasionally for coin. Its alloys with copper (bronzes) were cast into statues, arms, coins, and mirrors. Probably these alloys were produced, not by mixing the metals, but by the smelting of ore-mixtures containing both metals.

That Cornwall was, during the first centuries of our era, the chief source of tin, is shown by the new name, *stannum*, which replaced *plumbum album*, and which is a Latinized form of the Cornish *stean*, no doubt related to the German *zinn*, and the English *tin*.

After the fall of the Roman empire, other cities took this trade from Marseilles. Thus Cologne, subsequent to the Norman conquest, maintained a direct commerce with England; and in the twelfth and thirteenth centuries, Brügge controlled the whole West-European market, including that of tin. It was here that the Italian and German merchants made their purchases.

After the fourteenth century, the Mediterranean cities obtained a large share of the trade, sending their ships on the one hand to Britain, and on the other to Constantinople and Alexandria. Up to this time, the product of Devon and Cornwall ruled the market. Down to the thirteenth century, the "stream-tin" of Devon furnished much the larger portion; but the mines of Cornwall at last took the lead, and the placer-product of Devon became, and has remained, insignificant.

The royalties paid in Cornwall were at first excessive. About A. D. 1300, the sovereign received 40 per cent of the gross product; in 1480, the tax was 20 per cent to the sovereign and 20 per cent to the landlord; in 1600, the crown abated its claim to 10 per cent; in 1750, the percentages were respectively 6 and 10 to 12; in 1830, 4 to 5 per cent for the sovereign and 5 to 7 for the landlord was the rule; and since 1838, the former royalty has been entirely abolished.

It was in the thirteenth century that the Bohemian mines became largely productive; and during the fourteenth, they probably drove the British tin from the German market.

The manufacture and wide-spread religious use of bells, during the middle ages, is proof of a large consumption of tin. At the end of the middle ages, the introduction and increasing use of bronze cannon demanded still greater quantities of this metal. In the sixteenth century, other important ores were discovered: tin-foil for mirrors, tin-glaze for pottery, etc., and tin-enamel for metallic wares.

In the seventeenth century, Drebbel discovered the value of tin-salts in dyeing. A vessel containing extract of cochineal stood in his window. The window-panes were framed in tin. By accident, a little *aqua regia* was spattered upon the window, and a few drops fell from the tin into the cochineal extract, where they produced a bright red color. The acute chemist did not rest until he had discovered the cause of the phenomenon, and added almost a new art to civilization.

Among the disastrous effects of the Thirty Years' War—perhaps the most devastating calamity of modern times—was the almost total destruction, for at

least half a century, of the mining industry of Germany. The tin mines of Saxony and Bohemia shared in this prostration; but the ill wind that blew nobody any good on the continent transported prosperity to the shores of Albion. German miners were imported into England, and carried with them their knowledge of hoisting, timbering, draining, drilling, dressing, and smelting. Yet at that period the product of Cornwall was but 1000 tons of tin annually—not one tenth as great as that of the Asiatic mines.

In the eighteenth century, the tin industry of Bohemia and Saxony reached its climax. During the present, it has dwindled away. It was after the middle of the eighteenth century that Newcomen's "fire-engine," and in the "seventies" of that century that Watt's steam-engine was introduced in the Cornish mines. At the end of the century, the product of Cornwall had become 3000 tons annually.

During the first half of the present century, it was noticed that, with increased depth in the Cornish mines, the proportion of copper was increased, and that of tin diminished. This fact will indeed be found laid down in some books as a "law," at least for Cornwall, analogous to that other "law," concerning the decrease of gold in depth, which has been deduced from limited data by hasty philosophers. But since 1850 it has been found that, with still farther advance in depth, the proportion of tin has again become dominant. The "law" is simply one of alternation; and the product of tin, which has risen to more than 8000 tons per annum, is due to the courageous persistence of men who did not accept mere dogma as truth.

Since the above was written, we have received a pamphlet by Mr. Reyer (Zinn: *eine geologisch-montanistisch-historische Monografie.* Berlin, G. Reimer, 1881, pp. 248, 8vo), which deals with the subject much more fully, giving an admirable *rêsumê* of the geological, mineralogical, and metallurgical conditions, as well as the history of the different tin-producing regions, and a valuable catalogue of the publications which treat of different branches of the inquiry. From this pamphlet we take the following summary of production in metric tons:

	England.	Straits.	Banca and Billiton.	Australia.	Tasmania.
1870	10,200	4,000	7,500	Little	.....
1871	11,300	8,000	7,500	Little	.....
1872	9,600	10,000	8,000	1,000	.....
1873	10,000	7,000	8,000	6,500	.....
1874	9,900	8,000	9,000	11,000	Little
1875	9,500	11,000	9,000	13,500	Little
1876	8,500	10,000	8,000	12,000	3,000
1877	9,500	10,000	7,000	13,000	5,000
1878	10,000	?	?	?	8,000

The great new modern sources of tin are Australia and Tasmania. China is believed to have produced, a few years ago, at least 5,000 tons per annum; but the Chinese importation at present of some 10,000 tons every year of the cheap wash-tin of India seems to indicate a falling off in the domestic product.

The present annual product of the world is therefore about 50,000 tons It is principally used in Asia for the tinning of copper, and in Europe and America for the tinning of iron. The manufacture of alloys is believed to consume a minor portion only.—*Eng. and Mining Journal.*

THE GAMGEE PERPETUAL MOTION.

BY B. F. ISHERWOOD, CHIEF ENGINEER NAVAL DEPARTMENT.

[Chief Engineer Isherwood recently made a report to the Secretary of the Navy on the Gamgee perpetual motion, from which we make the following extract. The invention will finally, of course, rest on its actual merits :]—ED.

From observations made by Professor Gamgee in the experimental working of this machine, he deduced the possibility of what he terms a zeromotor, in which, by means of properly adapted apparatus invented by himself, the heat in water or other objects at ordinary atmospheric temperature may be utilized to vaporize liquid ammonia under very considerable pressures, but within the control of known means of retention. The high pressure gas thus obtained being used with the greatest practicable measure of expansion on a working piston generates power, becoming by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee, to the ammonia boiler whence it came. The cycle is thus a closed one ; no material is lost, and no heat is rejected in matter leaving the engine. The work done by the engine is due to the difference in bulk of the material when it enters and when it leaves the boiler, that difference being caused by the heat derived from water or other natural objects in the ammonia boiler and from the refrigeration resulting from the transmutation of a portion of this heat by the engine into the mechanical work performed by the latter. That this difference of bulk exists is indisputable, and if the proper mechanism can be contrived to utilize it, the idea of the zeromotor becomes realized. It will be observed that this power has not been obtained from artificial heat produced by the combustion of fuels, but from the heat of natural objects at ordinary atmospheric temperatures, and therefore costing nothing in money. This is made possible by the fact that liquid ammonia gasifies under considerable pressure at ordinary atmospheric temperatures, the sole difficulty in constructing the zeromotor being to find the means of economically condensing the gas after it has been used on a piston. Were it not for the refrigeration due to the expansive working of the gas, the condensation would have to be obtained by the application, externally to the condenser, of artificially produced cold, and the zeromotor could not be made a commercial success. It is only by obtaining the lower limit of temperature from the action of the engine itself, while the higher limit is furnished without money cost by natural objects at atmospheric temperatures, that commercial success becomes possible.

The purpose of the Department in ordering an examination of Professor Gamgee's ice making machine was not to obtain an opinion on its ice making merits, but one as to whether his observations on the behavior of ammonia in the process were sufficiently accurate to warrant his inference of the practicability of constructing a successful zeromotor for industrial uses—a motor, in short, destined to supersede the steam engine. Accordingly I have closely investigated the working of the apparatus. The facts of liquid ammonia gasifying at ordinary atmospheric temperature under very high pressures, and of that gas undergoing very great refrigeration when used expansively in doing work, are not called in question by any one. Both are well known phenomena. The special fact to be observed was whether any part of the ammonia which entered the cylinder as a gas left it as a liquid, and, so far as the form of the apparatus allowed any observation to be made, such appeared to be the case. The possibility of the invention of a new motor of incalculable utility would seem to be established, and in view of the immense importance of the subject to the Navy and to mankind at large, I strongly recommend it to the serious attention of the Department, suggesting further that whatever facilities the Department can, in its opinion, consistently extend, be allowed to Professor Gamgee for the continuance of his important experimental inquiries in the Washington Navy Yard. He is most anxious to bring his invention, with the least possible delay, to a crucial test by the completion of the necessary mechanism, and its submission to any board of experts which may be ordered experimentally to ascertain its merits. For this purpose he proposes to use such parts of his present ice making machine as can be re-combined in his zeromotor, adding the other necessary parts, and thus producing, with but little loss of time, an embodiment of his idea that will by simple trial show whether an unquestionably correct theory has been successfully reduced to practice.

Professor Gamgee has perfected the calculations and drawings for the mechanism required to give practical effect to his invention, and there remains only to execute the mechanical work. He proposes to use the steam cylinder of his ice-making machine as the ammonia cylinder of the new motor, the present ammonia condenser, and the present ammonia boiler as a low pressure boiler, adding another ammonia boiler as a high pressure boiler. These, together with the ejector between the condenser and the low pressure boiler, a small pump for pumping liquid ammonia from the low pressure to the high pressure boiler, etc., will constitute the zeromotor—a machine, as will be apparent from this brief description, of the simplest, cheapest, and most manageable kind.

In the high pressure boiler the liquid ammonia will be gasified by the heat in water of atmospheric temperature to the pressure normal to that temperature. In the low pressure boiler ammonia is kept at a considerably less tension than in the high pressure boiler, and with this lower pressure ammonia gas the engine is operated, the gas being used as expansively as practicable and made to do work during its expansion, thereby becoming refrigerated, greatly reduced in bulk, and partly liquefied. Immediately on being exhausted the cooled and shrunken

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gas, and whatever liquid of condensation may be mingled with it, are discharged by the ejector from the condenser into the low pressure boiler, the ejector being worked by the higher pressure into the high pressure boiler. As a result the low pressure boiler is continually receiving ammonia and heat from the high pressure boiler. This excess of ammonia in the liquid form is pumped by an ordinary pump from the low pressure back to the high pressure boiler, while the excess of heat is continuously being converted into the mechanical work done by the engine. There is also the extinction of such part of the heat in the high pressure ammonia gas working the ejector as is due to the work done by it in forcing the contents of the condenser into the low pressure boiler. Of course the cylinder, heat condenser, the low pressure boiler, and their connections are protected from receiving heat from the atmosphere and surrounding objects by a non-conducting substance.

The plan proposed is far from chimerical. It is based on well demonstrated thermodynamical principles. The whole is definite and precise, both in theory and mechanical detail, nor can it be shown, *a priori*, that there is not a fair prospect for success. There can be no doubt that the product of the pressure and volume of the contents of the condenser which are to be forced into the low pressure boiler, is less than the product of the pressure and volume of the ammonia gas which leaves that boiler to operate the engine, and that this difference which has not been produced by the external application of artificial cold, but by the working of the machine itself, is available for the production of power for industrial purposes. All that remains is to give the system a practical test in order to ascertain whether the mechanism proposed will act efficiently enough to realize the expected result. Should this prove to be the case, the steam engine will, within the near future, be certainly superseded by the zeromotor, for the great item of coal, whose cost is the principal expense of operating the former, will be wholly eliminated with the latter. If it can once be practically shown that a very much cheaper, lighter, and a far less bulky mechanism than the steam engine, including for the latter its boilers, and, in case of steam vessels, the coal bunker and its contents, can be employed for the production of power to any amount without the use of fuel, nothing can prevent its introduction into general use for all industrial purposes, with the vast result of a great cheapening to mankind of every article of manufacture, from the daily bread of the poor to the luxurious textures which robe the rich. The whole world is concerned in the solution of this problem, and the poorer the person the greater is his interest in it. The source of heat for the steam engine is the continually diminishing supply of coal—a diminution that will be severely felt some centuries hence; but the source of heat for the zeromotor is as inexhaustible as the sun himself, and will last undiminished as long as he shines.

The success of the zeromotor is of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe with which it may come in collision, because those powers have colonies and coaling

stations on the farthest shores, while the United States possesses neither, and would consequently, in naval warfare, be at great disadvantage for want of coal —its navy, as a rule, having to render service within a reasonable distance of its own coasts the sole base of supplies. If coal, however, can be dispensed with, we are at once placed on an equality in this respect, and our cruisers enabled to penetrate the remotest seas as easily as those belonging to countries having possessions there.

The enormous importance of a motor capable of superseding the steam engine and furnishing power without the combustion of coal can be estimated from the fact that it would produce an industrial and consequently social and political revolution equal to what was effected by the introduction of the steam engine. The whole of modern society is based on the steam engine which mainly has made the difference between the ancient and the present world, for our civilization would be impossible without it. It is the inanimate slave which performs the labor of mankind, freeing them from the greater part of their drudgery and giving them the time and means for culture.

I have ventured these few remarks to show the nature and scope of Prof. Gamgee's invention, which is not that of a machine for the application of power, but for the immensely more important purpose of generating power itself, so that, strictly speaking, it includes as a basis all other machines I have wished to show this in order to make clear how different is his invention from those of others who may ask to have their apparatus tested in a Navy Yard, and to bespeak for it the most favorable consideration of the Department.

Professor Gamgee and able assistants—among whom is Mr. W. E. Sudlow, an accomplished mechanical engineer, thoroughly versed in the the theory and practice of his profession — are well acquainted with the difficulties to be overcome. They are quite aware of all the objections that can be raised, and have well considered the means of obviating them. The subject has been carefully studied, and there are brought to bear upon it the requisite scientific and engineering information necessary to give it an exhaustive treatment. His engine, like the steam engine, is a heat engine, and produces power by the conversion of heat into mechanical work, the same quantity of work consuming in both cases the same quantity of heat, but with this immense practical difference, that the heat for his zeromotor is freely furnished to hand by nature, while for the steam engine it has to be excavated from the depth of earth and afterward handled and transported by expensive manual labor.

What is now mainly desired is that Professor Gamgee may be permitted to prosecute his experiments at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the Department be able to grant this, the favor will be well and properly bestowed in the interest of the Navy and of the world. —*Scientific American.*

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ARCHÆOLOGY.

PREHISTORIC MAN IN AMERICA.

BY PROF. EDWARD S. MORSE.

No subject in recent times has developed a larger or more active class of workers, or can lay claim to a more voluminous series of publications, than that pertaining to prehistoric man. Every nation working in science has added to its contributors, and these contributors have generally been drawn from a class already trained in methods of scientfic search.

So rapid has been the growth of the study of prehistoric man, that every student recalls its infancy and its advance to a vigorous science. He remembers the dread experienced at the thought of impeaching the clearly defined record of Genesis, and he recalls with impatience how long it was before the evidence which had been gathering for a century could command a hearing. Collections had been slowly accumulating, though lying dormant and dusty on museum shelves, and their records, unpublished, suddenly came into notice, and with a prodigality of material and data in numberless hands, the elements were ready out of which rose the new science of archæology.

So fully imbued were men's minds with the idea of the recent and historical origin of the human race, that no possible interest could be excited in what purported to be the evidences of a preadamite people. In vain did archæologists offer their evidences of the high antiquity of man. Their discoveries were treated with incredulity, and their arguments rejected as worthless. A memoir read by Mr. Vivian before the Geological Society of London was considered too improbable for publication. The massive authority of Cuvier, who denied the possibility of man's existence anterior to those animals which live to-day, prevented the acceptance of Dr. Schmerling's remarkable discoveries in the Belgium caves.

Unquestioned acceptance of the Mosaic cosmogony has not only prevented the earlier development of this science, but it has caused the loss of a mass of evidence which can never be restored. Discoveries have been suppressed, false interpretations have been put upon others, valuable material has been ignored or lost, and in one way and another the study of man's early existence has been thwarted up to very recent years.

The sudden and wonderful growth of the study of man's high antiquity has been wholly due, not to the evidences—for these had been despairingly thrust before the learned societies to be again and again rejected—but to the rapid acceptance of those rational views which recognize man's origin from the animals before him.

Once it came to be fully believed that man was a mammal in the sense that systematists had recognized him to be, but a species of mammal among hundreds of other mammals, who, with them, had some common ancestry, and the study of archæology assumed the rank of an inductive science. A short time has seen the formation of imposing societies, many of them highly endowed; of magnificent museums, devoted exclusively to the preservation and exhibition of objects pertaining to this science; the publication of anthropological journals and transactions, and, above all, the production of a large number of illustrated works, which bring the science to the comprehension of the general reader.

It is quite necessary to understand all this to comprehend the amazing growth of a study which should have interested the race centuries ago. At the outset, the term prehistoric man was looked upon as applying to a people who lived before the dawn of recorded history—a people who lived, not in any hypothetical Eden, but among other places, in the valleys of France and the caves of Belgium and England.

So limited was his area, and so apparently similar were all his characteristics, that for a time no further subdivision was necessary. A few years ago, comparatively speaking, his high antiquity and wide distribution over the face of the earth was not dreamed of. No account was taken of any possible geological changes having occurred since his appearance. It was enough to assert, with more or less positiveness, that his remains were synchronous with those of a few extinct species of mammals. That the contours of the land and ocean boundaries were essentially the same for prehistoric man as for his historic descendants, could not for a moment be doubted. That during man's early reign the English Channel and Irish Sea had no existence, and an uninterrupted sweep of forest extended from the regions of Paris and London and across and beyond Ireland, far out to the present one-hundred-fathom line, no one dreamed of conceiving.

In the light of this knowledge, it is instructive to quote Dr. Wilson's words in his "Prehistoric Annals of Scotland." In reference to the Scottish aboriginal traces he says: "There is one certain point in this inquiry into primitive arts which the British antiquary possesses over all others, and from which he can start without fear of error. From our insular position it is unquestionable that the first colonist of the British Isles must have been able to construct some kind of a boat and have possessed sufficient knowledge of navigation to steer his course through the open sea." Such were the positive and emphatic utterances of a writer who, in his recent valuable work on prehistoric man, in referring to this very passage confesses that this was no certain postulate after all, and who recognizes the profound geological changes which have taken place since paleolithic man first chipped the rude stone celts whose imperishable characters give us our only clue to his existence.

The hypothesis of geological changes of any magnitude being excluded, it was impossible at that time to grasp the true import of rude chipped flints deeply buried in river gravel. Just as soon as the early remains could be looked upon

as veritable fossils—the name sounded so ancient—to be studied in precisely the same way, and with the application of the same methods of reasoning as were brought to bear upon the remains of a paleotherium from the tertiary, or upon an ammonite from the Jura, then, and not till then, could his high antiquity be realized. And not until rude stone implements from the river-gravels and similar deposits were brought to light in France, Portugal, Germany, Brazil, India, New Jersey, and other widely separated countries, was the inconceivably long duration of man upon the earth acknowledged. The recognition of these evidences has been, and is at this time, hampered and retarded by a rigid and almost ridiculous scrutiny of every object bearing upon this subject. The study of other fossil mammals goes on unimpeded. Professors Marsh and Cope collect their fossils and assign them to their proper geological horizons unchallenged save by the hostile Indian. The archæologist, on the contrary, has (for his best good it must be confessed) standing over him one set of critics, generally theological, who deny his facts, or call his evidences spurious. He is belabored by another set, generally theological also, who claim for man peculiarities which separate him from all considerations which would apply to other mammals below him. By another set still, who, ignoring the doctrine of probabilities, are ready to call every skull, or other remains showing quadrumanous features, abnormal or pathological. Thus, the ape-like skull of the Neanderthal cave was looked upon as a synostotic cranium. The extreme improbability that, in these frequently occurring and widely distributed cases, only idiotic or abnormal forms should come to light, never seems to trouble these critics.

While the general acceptance of the theory of man's origin from the lower animals has induced the present activity in archæological research, it is equally true that the study has contributed valuable evidence to the general correctness of Darwin's views.

The divisions of the tertiary, though artificial, are recognized by the varying percentages of the species of mollusks which are now extinct. If we are fortunate enough to get the remains of the very early man—not his works, but his bones—we shall, in the same way, estimate his degree of savagery and bestial features, and, possibly, his age, by the proportion of those characters which are not only outgrown by man at the present day, but which bring the widely diverging lines of man and the apes a little closer.

Now, as we have to do with the remains of man, not in the beds of the tertiary, where superposition is well established, but with his remains found in modified drift, river-gravels, and other rocks, whose age and synchronism are so difficult to establish, it would seem that here the trained osteologist must take up the investigation.

The recognized sequence of rude stone implements, polished implements, bronze, and iron, while holding good for limited areas, becomes of less value for larger fields when it is known that tribes with rude stone implements are existing to-day. A few hundred years ago the European combatted with gunpowder the inhabitants of a vast continent who belonged to the neolithic age.

It is assumed by archæologists of great repute that since, in Europe, pleistocene deposits have yielded only the rudest of worked stone, therefore in no deposits older than the pleistocene can we expect to find evidences of a more primitive workmanship. This postulate may be admitted in regard to certain parts of Europe, for nothing more primitive than the rude celts can be imagined. Before this time, man, in that region at least, must have used natural fragments of stone and sticks, and even the faculty to use these indicates an advance far above his progenitors, who had not yet acquired this faculty.

It is again assumed that since man is the most highly specialized mammal, it is not conceived that he could have lived in the upper and middle tertiaries, because, of a large number of mammals living at that time, the species, and lower down the genera and families, are extinct; and, therefore, man, so far above these in organization, must have come in at a later date. On the other hand, it does not seem improbable that the single living species of man may be the sole survivor of a number of fossil species, and even genera, now extinct. Such a condition of things would find its parallel in many, if not in all, of the living species of mammals to day who represent the survivors of a line of species and genera far back in the tertiary.

In regard to the other assumption—that man is the most highly specialized mammal—we think even this is open to suggestive doubt. In that he possesses a highly convoluted brain, with all its capabilities and possibilities as we find him to-day, he certianly is highly specialized; but as a mammal—and only as a mammal must we regard him—he belongs to a more generalized type. If we consider him only in relation to those mammals nearest related to him, we find all his characters held by no one ape, and to find his resemblances one has to consult a variety of forms. His structural relations are found in the gorrilla, chimpanzee, orang, gibbon, *Simiadæ*, and even in the half apes, the lemuroids. It is true that most of his resemblances are with the higher apes, but these are not of sufficient weight to assure us that any of them are his progenitors. Indeed, if we care to credit such high authorities as Mortillet, Dr. Hamy, and others, man existed in the middle miocene associated with the first anthropoid ape, *Dryopithicus*, and in later beds still with *Oreopithicus*, which, according to Gervais, had affinities with the anthropoid apes, macaques, and baboons.

Professor Cope, in considering man's relations to the tertiary mammals, says that "the mammals of the lower eocene exhibit a greater percentage of types that walk on the sole of their feet, while the successive periods exhibit an increasing number of those that walk on their toes, while the hoofed animals and carnivora of recent times nearly all have the heel high in the air, the principal exceptions being the elephant and bear families." He then goes on to show the successive osteological changes of the foot from the earlier types to the later ones, through several lines of descent, and says: "The relation of man to this history is highly interesting. Thus in all generalized points, his limbs are those of a primitive type so common in the eocene. He is plantigrade; has five toes; se arate

tarsals and carpals; short heel; flat astragalus, and neither hoofs nor claws, but something between the two; the bones of the forearm and leg are not so unequal as in the higher types, and remain entirely distinct from each other, and the ankle joint is not so perfect as in many of them. In his teeth his character is throughly primitive. . . . His structural superiority consists solely in the complexity and size of the brain. A very important lesson is derived from these and kindred facts. The monkeys were anticipated in the greater fields of the world's activity by more powerful rivals. The ancestors of the ungulates held the fields and the swamps, and the carnivora, driven by hunger, learned the arts and cruelties of the chase. The weaker ancestors of the quadrumana possessed neither speed nor weapons of offense or defense, and nothing but an arboreal life was left them, when they developed the prehensile powers of the feet. Their digestive system unspecialized, their food various, their life the price of ceaseless vigilance, no wonder that their inquisitiveness and wakefulness were stimulated and develo ed, which is the condition of progressive intelligence;" and adding that "the race has not been to the swift, nor the battle to the strong," Professor Cope shows in this case that the "survival of the most intelligent, and natural selection proves to be, in the highest animal phase, intelligent selection."

Mr. Fiske shows, in another way, that when variations in intelligence became more important than variations in physical structure, they were seized upon, to the relative exclusion of the latter.

The earliest evidences of man must be sought for in his remains, for he must have existed in much the same condition many ages before the use of rude stone implements gave him any advantage in the struggle for life. These evidences have never been found. When man acquired the habit of seeking the shelter of of caverns, or the custom of burying in sepulchers, then it became possible to preserve his remains for future generations to study; but outside of these fortunate receptacles, his remains have been rareley met with. The probable habits of primitive man and his progenitors were of such a character as to render the preservation of his remains one of extreme im robability.

The herbivora, roaming in immense herds, fording streams, and seeking shelter from the flies and heat in watery places, where, if they died, all the conditions for the preservation of their remains might be expected; the amphibious mammals becoming well preserved in the matrix in which they perished; the colossal mammals becoming mired by their own weight; all these various conditions were favorable for the preservation of those remains which are found in the greatest abundance.

The arboreal ancestors of man, on the other hand, left their remains strewn on the forest-floor, or weathering in rude tree-nest, the most uncertain of all places for their final preservation.

Professor Marsh, in his magnificent monograph on the extinct fossil toothed birds of North America, testifies that fossil birds are of the rarest occurrence, and to their arboreal habits may be due their rarity; the remains of aquatic birds being always more common.

Even if early man and his progenitors sought shelter in caverns, Professor Dawkins, the distinguished British archæologist, shows that while there have probably been caverns in all geological periods, they have all been obliterated by "the rain, the alternation of heat and cold, the acids evolved from decaying vegetation, and the breakers on the sea shore," and this obliteration has been so thoroughly accomplished that there are only two caverns known that can be said to be as old as the middle pliocene.

Without entering into any discussion regarding the submergence of the coast line in many parts of the world, and its subsequent erosion, thus removing traces of ancient people who have sought the sea for food, we may accept the evidences offered to show that paleolithic man came from the south, for he makes his appearance along the southern borders of the northern ice-sheet.

It is a significant fact that, with the appearance of the glacial fields, the later tertiary apes were driven out of Europe, never to return, whilst paleolithic man came in, and was able to endure the very influences that caused the disappearance of the apes. This shows how vast a change had taken place at that early time between man and his anthropoid relatives.

He came from the south, from those regions where the least exploration has been carried on, and where the difficulties are generally greatest for such explorations. It is also in the equatorial regions that we have the hypothetical Lemuria, Atlantis, and other submerged areas, which were generally supposed to have been lands teeming with life.

An argument for believing that he lived in the earlier tertiaries may be found in the fact that his characters, as seen in the earliest remains, are yet promptly recognized as human. It is true they depart somewhat from the characters which distinguish the race to-day, nevertheless the race, with its wide variation, can compass, without violence, the most aberrant form yet found. It is man that is recognized, and not ape, and that man could have lived through such long ages with so little change is an argument that his progenitors must have lived long anterior to the earliest traces yet found.

If we consider the minor subdivisions of man in time since the neolithic age, we can trace some of his incursions. We can, as it were, see him coming from some unknown quarter, and frequenting regions never before inhabited by him.

(*To be continued.*)

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CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, April 23.

The earthquake at "Chio's rocky isle" has resulted in the death of 12,000 individuals. The catastrophe is dreadful. However, in the Caraccas in 1812, more than 20,000 persons perished. The first Lisbon earthquake, in 1531, destroyed 30,000 persons, and that of 1755, 50,000, not counting its recoil in Morocco, where 12,000 inhabitants perished. The "shock" extended even to Scotland, as such travel at the rate of 470 to 530 feet per second. From 1785 to 1857, the then Kingdom of Naples lost 111,000 inhabitants. As for the victims in Peru, earthquakes appear to be a matter of course in that region. Respecting the catastrophe at Chio, which occurred on the 3d of April last, the first shock took place at forty minutes past one, and lasted eight minutes. Few houses resisted; twenty minutes later a second, and then a third shock ensued which destroyed the few houses that at first escaped. The shock had a kind of spinning movement, in the direction east-west, and changed the sites of buildings by six to eight inches. The cracks in the ruined dwellings commenced from below, eastward, terminating always at the top, westward. The only minaret in Chio that escaped was that built in cut stone; all constructions in masonery were overthrown without exception. Not only the kind of building materials employed, but the nature of the building site, has much to do with the resistance. The shock traveled very rapidly over the gneiss and mica-schist rocks, and was next to stopped in the plains. Along soil of a volcanic origin the shock was very intense; on the contrary in the case of alluvial soils, it was next to insensible. The gravity of the Chio catastrophe is due to the fact that the soil is of eruptive origin. When the earthquake took place the sea was as smooth as glass, the sky overcast, the atmosphere heavy, the wind southerly—the precursors certain of an earthquake. M. Fouque is of opinion that the disaster at Chio is to be attributed to a sinking of the soil. M. Lacau thinks the contrary; hence, there is nothing certain. The volcanic axis or line does not positively traverse the island, so that it is possible internal erasions having taken place, the superincumbent rocks, simply in their profound depths, fell in, producing the convulsion; thus there would be no connection with such a result and a seismic origin. The transformation of a portion of the Island of Reunion three years ago is owing to such a cause. In any case the moral of the Chio calamity is this: abstain from occupying isles of a volcanic origin, as being devoid of stability, and if occupied, erect only structures of a special order, and as widely separated as possible.

The trichina causes less anxiety. No person has been affected by the malady,

and though America be accused of importing the disease, the United States never made larger consignments of ham and pork to France than at present. It was an unsettled point as to whether or not the worm existed in the fat—its natural home being the muscle. M. Chatin, after devoting much attention to the solution of the question, has finished by discerning it in the fat of bacon.

Some months ago four laborers, employed to look after the city sewers, descended by the trap door into a main situated on the Boulevard de Rochechouart. Fifteen minutes later they were brought up suffocated. Inquiry demonstrated that they were victims of the reprehensible practice of the drivers of the night-soil carts, emptying the liquid stuff into the sewers—an act severely prohibited. It was alleged by the Night Soil Company that death could not have resulted from such a cause, admitting even that the carters had been guilty. The authorities directed Messrs. Boutney and Descourt to investigate the matter. They have just made known the result. The night soil liquid disengages poisonous gases, even when disinfected with sulphate of copper They placed Guinea pigs in a cage and submitted them to the gases emanating from a night-soil reservoir. The animals died within a period of five seconds and three minutes. The experiment was repeated on a large dog. After two minutes it fell on its side; another minute and it expired. The capacity of the cage in which the Guinea pigs were enclosed was 3½ gallons. One quart of liquid was poured inside; the animals expired in five seconds. So much for the unpurified liquid. That disinfected invariably produced death in the space of five minutes Chemical analysis demonstrated that the toxical gases disengaged were sulphuretted hydrogen and sulphhydrate of ammonia; that the non-disinfected liquid, when shaken, gave off per quart 140 per cent of sulphuretted hydrogen, and the disinfected 40. Further experiments showed that the 200th part of that hydrogen in the air sufficed to suffocate animals; that a cubic yard of the non-purified and the same quantity of disinfected liquid poisoned respectively twenty-eight and eight cubic yards of air so as to render its respiration mortal.

In France it is an old woman's remedy to conduct children suffering from whooping cough to breathe the air in the refining chamber of a gas factory. The inspiration of the gas was never known to do good, and Dr. Poincarè now asserts that after numerous experiments on animals, he found that their lungs had been profoundly altered by breathing coal gas; that granulations were produced.

In the cavern of Lherm, in the department of the Ariege, paleontologists draw their supplies of bones of carnivorous animals that sought refuge there during pre-historic times. Bears' heads are very plentiful, and M. Filhol has presented specimens quite different from any race of bears hitherto known. He also concludes the white polar bear has come southward and accommodated its habits to the life of other bears. The same cave in question has yielded the fossilized femur of a lion, 18 inches long—proof that the animal must have been of an enormous size.

M. Reyrusson has discovered an azoteous ether, not only a perfect disinfectant, but an antiseptic at the same time, the only agent filling the two roles effectively. Its preparation is, however, costly. Messrs. Girard and Pabstdisinfect night-soil reservoirs by dissolving lead crystals in sulphuric acid, when azoteous acid, a very active agent in acidation, is eliminated. M. Sulliot has tried to disinfect sick chambers with the Girard and Pabst process, but the fumes of the disengaged acid are rather too irritating for the patients. It is an excellent agent in the case of cess-pools, and so is employed in the Hospital la Pitie, in that end, where the night-soil reservoirs are so vast. The gases eliminated from the latter are collected in a chimney filled with coke and wet with sulpho-nitric acid.

Paper, like wine, seems to be made out of every matter. Wood is largely employed, and when mixed with a little rag, becomes more tenacious. It is the cellulose matter of the fibre that is utilized. Messrs. Deung & Co. have made a rapid stride to solve the pressing question of finding a substitute for paper, and have succeeded with cow and horse excrements, by submitting them to the action of sulphuric acid. The animals, however, must be fed on a strictly cellulose diet, grass, hay, etc. Beautiful white paper has thus been manufactured, and the residue can be employed to produce ammonia, aniline, epuchsine, etc.

Closely connected with this subject is the production of sugar, also from cellulose matters, whether these be old shirts or saw dust. By submitting such substances to the action of sulphuric acid, which thus converts them into dextrine, the latter, after being placed in a solution of lime, is again operated upon by sulphuric acid, that converts it into syrup or glucose, which, though not crystalized, is not the less sugar, and is extensively employed in the preparation of jams, jellies and bon-bons. In France wood, as in Germany, is being tried for the preparation of sugar, and one manufactory turns out large quantities of glucose by operating on starch, which is also a cellulose body.

For tinning sauce-pans about 5 per cent of lead is added. When this percentage is exceeded, toxical results may be anticipated M. Maistrasse indicates a means for the detection of the excess, or to ascertain if the tin be pure. Wash the surface with muriatic acid, or diluted in water. If a characteristic black results, the proportion of lead has been exceeded. Pure tin leaves no such black stain.

There are many means for inducing sleep. Drowsy syrups are chiefly resorted to, and also sub-cutaneous injections of morphine. Preparations of bromine are also employed, and chloral is an important agent. Dr. Bisenz, of Vienna, has a cheaper remedy than any. He maintains all that is necessary is an indulgence in forty winks, almost. He literally recommends to open and shut the eye lids thirty times in succession. This induces such a fatigue of the muscles that the patient falls unconsciously asleep. It is said that it is quite a common place remedy in Persia. In that country there is also a cheap and effective way for

curing hiccups. Cause the sufferer to hold his arms above his head for a few minutes. Startle him with some sensational news, specially imagined, and the inconvenience will be the more speedily laid.

The Touaregs tribes, occupying the South of Algeria, have breeds of sheep and asses remarkable for their immense size, only the former have hair instead of wool. A society is in process of formation to acclimatise many European animals in Algeria, and to work up the natural products of that country. It is thus that sponge is being exported of late, though it be not of such a superior quality as that from the Grecian Archipelago. Attention will also be directed to the rearing of bees, of which the rich flora of the colony and its mild climate present superior advantages.

Two volumes worth reading, "Les Infininent petits," by Felix Heinent, and the "Curability and Treatment of Pulmonary Consumption," by Dr. Jaccoud. The Doctor dissipates many obscure points, and his work is written in so seductive a style as to cease to have the air of a medical treatise. M. Jaccoud is the author of that profound remark, "The treatment of the phthisical is only a long meditation upon death."

METEOROLOGY.

SOMETHING ABOUT TORNADOES.

BY S. A. MAXWELL, MORRISON, ILL.

In studying the charts contained in the reports of the Chief Signal Officer, I discovered a number of facts relative to tornadoes, which, so far as I know, have never yet appeared in print. One of these is the fact that these meteors almost invariably occur on the south side of the line of minimum barometric pressure. I have said *almost* invariably, because my investigations are yet quite limited—having extended but little outside the year 1878. During the period included in the investigation, there does not occur a single exception to the rule, as the facts herein stated will show.

Areas of low barometer or storm areas, generally move across the United States in an easterly direction; and the storms accompanying take very nearly the same course. It has been determined that the greater quantity of rainfall takes place in the front half of the area of low pressure. This is evidently due to the fact that warm winds prevail in this portion; and these as they approach the storm-center rise to the region of "upper clouds," where their moisture is condensed, and precipitation is the result. Now the following facts will show

that the tornadoes noted by the United States Signal Service Corps, during the year 1878, occurred in that half of the storm area lying toward the equator.

An area of low pressure, originating in the Pacific Ocean, west of Oregon, passed southeast over the Rocky Mountains and onward to central Texas, thence to the northeast, finally leaving the United States at Cape Cod. The storm-center was at Memphis, Tennessee, on the 7th of February, 1878, and on that day destructive tornadoes occurred in Richmond county, Georgia, and during the forenoon of the next day at Augusta, Georgia, and at Fayetteville, North Carolina. These localities were from 300 to 400 miles south of the track of minimum pressure.

The next tornadoes of the year occurred on May 23rd, at Mineral Point, Wisconsin, at Barrington, near Chicago, and at Quincy, Illinois. In this instance the center of low pressure is traced from British America, just north of the Montana line, (May 22nd,) eastward to the Gulf of St. Lawrence, which it reached on the 27th. The storm center reached the meridian of Mineral Point early on the morning after the tornado. In this case, as in the others, the tornado was 400 miles south of the path of minimum pressure, and at the time of its occurrence, was 600 miles southeast of the storm-center. The storms at Barrington and Quincy were near the outer borders of the storm-area, and probably for that reason were much less destructive than the terrible cyclone which devastated southern Wisconsin.

Tornadoes occurred at Gardiner, Illinois, and at Davenport, Iowa, on May 31st. The storm-center was in southern Kansas on the morning of that date, and in northwestern Iowa in the evening. Note the similarities of this with the preceding.

A storm-center, originating in northern Colorado on the morning of June 1st, passed northeast, leaving the continent north of the Gulf of St. Lawrence. At about three o'clock p. m. of the day named, a tornado occurred at Richmond, Mo.; at which time the storm-center was at Grand Island, Nebraska. This was quite a destructive storm—over a hundred buildings being destroyed at Richmond and thirteen persons killed. By turning to the map of the United States, one can see how clearly this storm resembled that at Mineral Point in relative positions of storm-center, and locality of tornado. About an hour after the Richmond tornado, another took place on the Platte river near Clarke's Station, Nebraska, and what is worthy of notice, within twenty miles of the storm-center, but still to the southeast of it.

A storm-center, originating on the evening of June 8th, in northwest Kansas, moved east, reaching Cape May in just 48 hours. At 4:30 p. m., on the 9th, it had reached the extreme northeast corner of Kentucky. A tornado occurred in Richmond county, Georgia, on this date—the hour not given in the Chief Signal Officer's Report. Assuming that it occurred at 4:30 p. m.—the hour of their most frequent occurrence, we find the storm center about 400 miles northwest, as in a number of instances previously cited.

A storm-center was in Canada, just north of Lake Champlain at 1:20 p. m.

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of July 21st; a tornado occurred in eastern New York, 200 miles nearly due south, at the same hour.

A tornado did considerable damage in Washington county, New York, on the 26th of the same month. It belonged to a storm-area, whose center passed near Rochester at the hour the tornado occurred, viz.: 5:30 p. m. In this case the locality of the tornado was somewhat farther north than the storm-center, but yet on that side of its path *toward* the equator.

The destructive tornado occurring at Wallingford, Connecticut, August 9th, belonged to a storm-area, whose center never entered the United States, being first reported from near Vancouver's Island, whence it moved almost due east, leaving the continent at the Gulf of St. Lawrence. At 6:00 p. m. of the 9th, it had reached a point about fifty miles north of Quebec. At this hour the Wallingford cyclone occurred. In this instance the tornado happened about 400 miles south of the line of "low," and somewhat in the rear of the storm-center.

The last tornado, recorded for 1878, destroyed Sherman City, Isabella county, Michigan, on the 20th of September. The track of minimum pressure was traced from Dakota, eastward over the northern part of Lake Huron, thence through northern Canada, in a line nearly parallel with the river St. Lawrence. It will be noticed that the tornado occurred to the south of this track, but at no great distance from it. As in the case of the Wallingford storm, the center of the low pressure had passed the meridian of the locality where the tornado was developed.

In this list of storms, I have not included one that did not bear the distinct features of a tornado. In newspaper phraseology the term tornado is applied indiscriminately to severe storms of wind, accompanied by rain; but, strictly speaking, it applies only to such as are distinguished by a rotary motion, precisely like that of an ordinary whirlwind. In my researches on this subject, I have found that a large majority of the destructive storms of 1878, occurred in the south half of the storm-area; and I think that further investigation will prove that nearly one-half of all the destructive storms are developed in that quarter of the storm-area which is in the anterior half, and at the right of the path of minimum pressure.

Let us recapitulate. Of the ten genuine tornadoes of 1878, just *one-half* happened in May and June; all but one or two, in the afternoon; *seven* were in advance and *three* in the rear of the storm-center, at distances varying from 20 to 600 miles from it; and *all were on the equatorial side of the path of minimum pressure.*

In this article I have made a brief statement of a few facts, inaccessible, perhaps, to a majority of the readers of the REVIEW, from which material all who desire may rear the fabric of their individual conclusions. Only from an accurate statement of facts can we build tenable theories or deduce the laws of science.

Morrison, Ill., April 30.

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THE PASSING OF "LOW" BAROMETER.

BY ISAAC P. NOYES, WASHINGTON, D. C.

"Low," it may be proper to say, is the short and technical term for low barometer, and that the passing of "low" refers to the movement of this condition over the country.

* * * * * * * * *

The storm center, *low*, is the governing point, the "passing of *low*" over the country is the agent of the storm. Back of this, of course, is the concentration of the sun's rays, which produces, over the world's surface, points or localities of rarification of air which are continually on the move—we think, ever and ever around the world. We cannot prove this at present for want of stations, yet we have the best reasons to believe that such is the fact.

When one becomes familiar with the laws governing the weather, especially with that which is positive and not merely speculative knowledge, it is very absurd to hear people even suggest such an idea, that there must be some other laws unknown to those who knew the most, and essentially all there is as to the general laws governing the matter, and that some ignorant person with great pretentions knows more, especially so when his ignorance is manifest in all that he says. But, says the common sense of the world, has he not produced results, and are not results the thing after all? What matters science and full and complete knowledge if some half-witted fellow can, every time, do better than the wise and scientific? *Results* are what the practical world demands. Well, *we* want results, and we think it very absurd for a man to pretend to know so much about the weather, and not be able to tell for one locality as well as for another, to be able to tell fair weather as well as great "eleven-foot snow storms," etc.

We challenge him, or his friends, to produce any results beyond those which any other guesser of the weather can produce.

To those who know nothing of the law of periods, which storms follow, and their causes, it seems very strange to see a man say that it will, according to the time of year, snow, rain, thunder or blow *somewhere* over the vast territory of the United States on the 2d or 4th, 7th or 8th, 11th or 12th, etc. Yet to the person who knows these laws, it is no more strange than if A knows that B is about sure to be within or in the neighborhood of a certain large area every four days on an average, for A to put on a wise look and say B will be there on such and such days of the month. But, after all, there is no satisfaction in such a statement, for many others know the whereabouts of B even better than A, but neither A nor all the others who have this knowledge know *just* where B is going to strike, how he will strike, what will be the result, and whether he will move over one section or another, or produce a certain effect every time.

Then, if this "weather prophet" who has created such a sensation has reliable knowledge, and can figure it out months in advance, does it not seem absurd in him simply at first to make a general statement covering what everybody

knows is the most probable thing to expect, for example, that "March will come in like a lion, and go out like a lamb," etc. Does it not seem absurd for him not to give the detail knowledge at the time he gives the general knowledge that everybody knows as much about as he?

But there is method in this plan of *general knowledge first, and detail knowledge after a while*, say about the middle of each preceding month.

Through the month of March and up to the 16th of April, the storm centers passed this meridian at very regular intervals, but then came a change, and the four days interval, which had been so regular, was broken.

The way to accomplish this, is general prophecy first, and detail prophecy after awhile. The method of it is first to publish, for the different months of the year, such weather as may be expected to occur. Then for details, about the middle of the month preceeding, note how the storms are running.

As often stated in these papers, a storm passes over the territory of the United States once in about three or four days—four days is a fair average. About the middle of the month, say as in February, this year, figure out the month ahead on this basis: If the season has been rather cold, predict snow, cold winds, etc. About the middle of February, this year, it would figure out for the meridian of Washington, the 3d to 4th, 7th to 8th, 11th to 12th, 16th to 17th, etc. This basis for a four days' interval, especially for the month of April, till after the 16th, was very regular, for the meridian of Washington, the 1st, 4th, 8th, 12th and 16th, but after the 16th the interval of four days was broken, and another storm appeared here on the 18th. But predictions on this basis, after all, do not, and did not, amount to any practical value; the storms were not all alike, and did not pass over the same lines—there was no resemblance to each other beyond being storms. They did not originate in the same place, nor follow similar tracks, excepting the general easterly direction of all storms; some came from the extreme southwest, others from a little higher line, while still others came from high up in the northwest, each taking tracks peculiar to itself and producing unlike results. As a rule, however, they all passed this meridian more or less south of Washington, after which they took a northeast course toward the northern part of New England and Eastern Canada; and this was the general course which the majority of storm centers, *low*, took through the greater part of the winter, and the reason why it remained so cold throughout the greater portion of the United States, the reason why we had no January thaw, and why it was relatively, at least, warmer way up in Maine than throughout the more southern country, and why this spring they have had such terrible floods out west. Had *low* traveled on a high line of latitude during the mid-winter months, we would have had the usual thaw, and streams would have been relieved by degrees.

As before often stated, the "passing of *low*" is the regulator in these matters. If *low* passes on a high line, it will be relatively warm, if on a low line, cold, if on a medium line, neither cold nor warm. If on a high line, it will create southerly winds; on a low line, northerly winds; if on a medium line the north winds will not go far south, the southerly winds not far north. There will

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be a compromise, as it were, between the north winds and the south winds, the result of which will be a medium temperature.

These statements are not mere theories nor ideal conceptions, but substantial facts, which can no more be disproved than that water will run down hill, or that combustion will produce heat.

But what about that snow storm in Chicago on the morning of the 19th of March, when Mr. Vennor said that about the 20th of March or thereabout, there would be a great snow storm in the "lake region," and that, too, said some weeks in advance, when on the very morning of the 19th of March, the weather bureau said that the indications for this region were for fair weather.

At first it certainly appears that the weather prophet was at least right *that time*, and that the weather bureau, to say the least, committed a most awkward blunder. But before we commit ourselves, let us weigh well the facts in the case, and consider well the causes which produced the snow storm.

In the first place, the Signal Office takes three observations daily—at 7 a.m., 3 and 11 p. m.

An average speed of *low* is about three hundred and fifty to four hundred miles in twenty-four hours. When the storm center *low* is at St. Louis on one day, on an average, on the morning of the second day thereafter it will be at Washington.

There is, however, no regularity about the speed of *low*, for sometimes it will even go from the base of the Rocky Mountains to the Atlantic coast in twenty-four hours. But these instances of great speed are exceptions. I only mention this irregularity of speed to show that there is no knowing before hand, at least at present, the rate at which it will travel. As little can we know in advance the direction it will take. And this illustrates one of the greatest difficulties with which the signal office has to contend. They see a storm in the west. What time will it reach the meridian of Washington? If they give out an "indication," it must be founded upon the *average* and *not upon the exceptional* speed. Again, if a *low* is in the west, what course will it take? This is fully as important as the speed. It may keep on a straight line and follow a line of latitude in its course, or trend more or less to the north as it advances east.

On the morning of the 18th of March, low was in the extreme southern portion of Texas, with the center even still further to the west, or southwest, but owing to the want of stations in this region we cannot tell exactly where the *center* was, but we do know that it was somewhere beyond Brownsville.

The morning reports for the press must be made up at midnight—to accommodate all parts of the country, one will see that the reports could not be much later.

At 11 o'clock on the night of the 18th of March, *low* had advanced up into Mississippi.

These southwestern *lows* had, prior to this, traveled within certain lines, or probably better, traveled within a certain arc. They had either gone straight across the country, passing off the land on the Florida coast, or in their passage

trended more or less to the northeast, extending to an arc of forty-five degrees, and not taking a direction more north than this. The one preceding this of the 18th, was picked up in Texas, at a higher line of latitude, yet it did not sweep a curve higher than Washington, and then took a slight downward course, and passed off the coast in the neighborhood of North Carolina. From all past experience, it was expected that this *low* would reach a higher line than Washington, or that it would reach this locality before the 20th, and probably not until the 21st; and little was it expected that it would go in the direction of Chicago. But instead of doing what its predecessors had done, what was naturally supposed it would do, it, instead, took an unprecedented course from where it was at 11 o'clock on the night of the 18th, and went with unprecedented speed almost due north!

For the day of the 19th of March the indications for the "lower lake" region were "fair weather, westerly wind, becoming variable; stationary or lower temperature, nearly stationary barometer."

By the time the indications were in press, the *outer lines* of the storm had reached Chicago, and presented a strange contrast with them.

In order to have brought that snow storm to Chicago on the morning of the 19th, *low*, at the least calculation, must have traveled fully a thousand miles in twenty-four hours, and that, too, in a direction as remarkable, if not more so, than the speed. Had *low* moved only at the rate of 350 or 400 miles in twenty-four hours, when it reached Chicago, it would have brought so much warm air with it that it would have produced a very warm rain, instead, as it did, a severe snow storm. With the map in the like condition of March 18th, the chances are that the same indications would be given to the country every time, and ninety-nine times out of a hundred they would have been fulfilled.

With those ignorant of the weather system, the passing of this *low* was very detrimental to the signal office, and brought great honor to the "weather prophet" of Canada.

Here are the facts of the case, and no white-washed or dressed-up facts are they, for such facts as these cannot be covered or made to appear in any other light than that in which they appear and are recorded. With this knowledge there are only two lights in which to see Mr. Vennor, the "great Canadian weather prophet." He is either ignorant of the whole weather system, or has allowed himself to be unjustly praised, and that, too, when this praise has carried with it the severest censure upon a worthy and honorable institution, and more, upon worthy, able, honest and earnest men, who are trying to make our weather bureau the most complete of the world, and who are laboring industriously for the advancement of true science; and even carried with it a slur upon Americans as a people, and America as a nation. And yet in this contest, a contest worthy of the interest of the wisest, where do the intelligent people of the country stand —even scientific men? Why, they fold their hands, refuse to investigate the weather system, even at the paltry cost of two cents a day, and join with the rabble, who know no better, and actually condemn their peers without the trouble to in-

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vestigate the causes and facts in the case. They can thank or blame themselves. The opportunity to learn has been presented to them. For a number of years the weather map has been submitted to them, but they have paid about as much attention to it as they would to the croaking of the frogs in the pond.

The great difficulty with the world is that, through various causes too numerous and intricate to enlarge upon here, it is inclined to seek explanation for scientific phenomena through that which is in itself unexplainable, weird, mysterious and far-fetched rather than through the channels of plain matter of fact. For example, hardly a week passes but that some gifted writer, some person holding a high position in the world, and acknowledged even as high scientific authority, insists and persists upon connecting the weather of our globe with the moon, the stars, the icebergs, electricity, etc., and particularly just now with the stars. Because certain planets happen at this time to be nearly in a line with the sun, they become quite eloquent over what they imagine to be the effects produced by it. Though they can prove nothing by this system, and while all can be proved and sustained by the facts connected with the weather map, they still persist in ignoring the plain facts before them, and seek explanation in that which is as idle as the tales of old Sir John Mandeville about the geography, physical and ethnological science of his day. Instead of having faith in such spirits as Columbus, Raleigh and the Cabots, in men who seek to discover facts in regard to the world, they prefer, like old Sir John Mandeville, to "go to Alexandria," and there accept all the idle stories of those who know no more about the facts than themselves, and then deal them out to their neighbors as truth, while they let the real facts of the case remain undisturbed, and unaided allow the spirits of Columbus, Raleigh and the Cabots to wrestle, poorly provided and single-handed, with the storms of unknown seas. They flatter themselves that their way is the best and the only way, and, therefore, they continue to remain in ignorance of the true facts. It is not to be wondered at that they are so ready to condemn such an institution as our weather bureau, and to extend such praise and sympathy to such "weather prophets" as are trying to take advantage of their ignorance. The weather bureau can well afford to "abide its time."

To come back to the Chicago snow storm, if Mr. Vennor is ignorant of the causes which produced the storm there on the 19th of March, he is to be pitied, on the other hand, if he knows enough of the weather system of our globe to be able to understand these causes, he is wanting in a high sense of right, in remaining silent in regard to it. Were he familiar with the causes, he has had ample time ere this to have published a note in the papers in regard to it; but as he has not done so, up to the time, (April 30th, '81,) the most charitable light in which to view him, is as ignorant of the laws of meteorology—ignorant in the very department in which he endeavors to excel. By the world at large, this Chicago snow storm was his climax of honor; as the world advances in intelligence in this direction, it will prove an avalanche that will bury his reputation as a meteorologist out of sight for all time, unless he learns as he lives, and, with the increase of knowl-

edge, comes forward and does what an honorable man would do under the circumstances—acknowledge that there are things in meteorology which he had not, up to that time, dreamed of.

I have here suggested meteorological clubs—I would not have them expensive institutions. I would have the people of America take hold of this subject in a wise, common sense American way.

I will repeat that I do not speak *ex cathedra* for the weather bureau. I simply here speak in the interest of science, enlightenment, and right. I believe it to be for the best interests of all good and wise American citizens—indeed the citizens of the whole world—to be familiar with this question, at least as familiar as they are with natural philosophy, geography and the arts.

Let the people of the country understand the *Passing of Low*, be able to comprehend its meaning and the technical meaning of *High and Low*, and the weather bureau will no longer be the insignificant and almost contemptible thing that it is. It will not have to go a begging for a mere existence. Its friends and patrons will spring up in every township, and hosts of friends will be glad to do it service, fight its battles and protect its honor.

A careful daily study of the weather maps—noting the movement of storms -- how an area of *low* is picked up in the West, on a high or low line of latitude—how it travels eastward—the line, the course and spread it takes—how rapidly it moves at one time, how slow at another—how it varies with the seasons—how it readjusts temperature—how it generally works to the north as the sun rises in the ecliptic, and how high a line it reaches at times even when the sun is along the lower line of the ecliptic—how January thaws are produced—the cause of the peculiar weather which makes the seasons; the severe cold of winter, the warm spells of mid-winter, the cold spells of mid-summer—the high winds of February and March, the warm spells of May and Jnne, the hot and dry spells of July and August—the cause of that peculiar condition of weather which we term "Indian Summer," the climax of the year when Nature, especially here in America, appears in her most resplendent colors, when the harvest-moon is in all his glory and the fruits of the year are being gathered for the benefit and comfort of man and beast through the long winter. To be able to understand such things—to know how to account for them. It would seem that such knowledge was well worthy the interest of the wisest, instead of being their contempt or indifference.

The world little dreams of the interest centered in these maps. To neglect them longer, is to remain in willing ignorance, and this, it would seem, was not the part of wise men to do. There is much poetry, as well as good common sense, in the full understanding of the *Passing of Low*, to comprehend it is to gain much wisdom on a subject that is full of beauty and of great practical benefit to mankind.

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THE DARK DAY IN CANADA.

In some interesting and graphic reminiscences of Montreal sixty years ago, Mr. J. H. Dorwin writes to the Montreal *Star* as follows:

What was the strangest occurrence of that time, or rather the strangest thing that ever happened in the history of this country, was what has been always known as the "Phenomenon of 1819." On the morning of Sunday, November 8, 1819, the sun rose upon a cloudy sky, which assumed, as the light grew upon it, a strange greenish tint, varying in places to an inky blackness. After a short time the whole sky became terribly dark, dense black clouds filling the atmosphere, and there followed a heavy shower of rain, which appeared to be something of the nature of soapsuds, and was found to have deposited after settling a substance in all its qualities resembling soot. Late in the afternoon the sky cleared to its natural aspect, and the day was fine and frosty. On the morning of Tuesday, the 10th, heavy clouds again covered the sky, and changed rapidly from a deep green to a pitchy black, and the sun, when occasionally seen through them, was sometimes of a dark brown or an unearthly yellow color, and again bright orange, and even blood red. The clouds constantly deepened in color and density, and later on a heavy vapor seemed to descend to the earth, and the day became almost as dark as night, the gloom increasing and diminishing most fitfully. At noon lights had to be burned in the court-house, the banks, and public offices of the city. Everybody was more or less alarmed, and many were the conjectures as to the cause of the remarkable occurrence. The more sensible thought that immense woods or prairies were on fire somewhere to the west; others said that a great volcano must have broken out in the Province; still others asserted that our mountain was an extinct crater about to resume operations and to make of the city a second Pompeii; the superstitious quoted an old Indian prophecy that one day the Island of Montreal was to be destroyed by an earthquake, and some even cried that the world was about to come to an end.

About the middle of the afternoon a great body of clouds seemed to rush suddenly over the city, and the darkness became that of night. A pause and hush for a moment or two succeded, and then one of the most glaring flashes of lightning ever beheld flamed over the country, accompanied by a clap of thunder which seemed to shake the city to its foundations. Another pause followed, and then came a light shower of rain of the same soapy and sooty nature as that of two days before. After that it appeared to grow brighter, but an hour later it was as dark as ever. Another rush of clouds came, and another vivid flash of lightning, which was seen to strike the spire of the old French parish church and to play curiously about the large iron cross at its summit before descending to the ground. A moment later came the climax of the day. Every bell in the city suddenly rang out the alarm of fire, and the affrighted citizens rushed out from their houses into the streets and made their way in the gloom toward the church, until Place d'Armes was crowded with people, their nerves all unstrung by the events of the day, gazing at, but scarcely daring to approach the strange sight

before them. The sky above and around was as black as ink, but right in one spot in mid-air above them was the summit of the spire, with the lightning playing about it shining like a sun. Directly the great iron cross, together with the ball at its foot, fell to the ground with a crash, and was shivered to pieces. But the darkest hour is just before dawn. The glow above gradually subsided and died out, and people grew less fearful and returned to their homes, the real night came on, and when next morning dawned everything was bright and clear, and the world was as natural as before. The phenomenon was noticed in a greater or less degree from Quebec to Kingston, and far into the States, but Montreal seemed its center. It has never yet been explained.

METEROLOGICAL REPORT FROM APRIL 20, TO MAY 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL.

The period of this report from April 20th to May 20th, has been one of remarkable vegetable growth. There have been showers on fifteen days, but no very heavy rain. The largest rainfall was in a shower on the 18th, when 0 98 inches fell. Four of these storms have been accompanied by lightning and thunder, but there has been little strong wind. The rains have also in great part fallen in the night, and thus in every respect were calculated to accomplish the greatest amount of irrigation of the soil compared with the total rainfall. The promise of fruit and crops in this section, and in most of the State, is at present excellent. To illustrate the advancement of the season it may be observed that wild roses were in bloom here May 12th, and Syringa (P. Coronarius) on the 20th.

The miles traveled by the wind are only about two thirds of that recorded last month.

The highest pressure was 29.28 in. April 29th; the lowest 28.72 in. May 9th; range, 0.56 inches.

The highest temperature was 86° on May 15th; the lowest 48° on May 2d; range, 38°.

The lightest velocity of wind was 38 miles on the 10th, and no calms have been observed.

For the first time in several months, we notice a great prevalence of south winds. The northeast winds have been next in frequency. The humidity has been high, especially in the last two decades.

It can hardly be said now, in spite of the late state of vegetation, that the season is backward.

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	Apr. 10th to 20th.	Apr. 20th to 31st.	May 1st to 10th.	Mean.
TEMPERATURE OF THE AIR.				
MIN. AND MAX. AVERAGES.				
Min.	51.9	57.6	60.6	56.7
Max.	75.9	77.6	79.9	77.8
Min. and Max.	63.9	67.6	70.2	67.2
Range.	24 0	20,0	19.3	21.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	56.1	63.0	65.4	61.5
2 p. m.	71.6	73.6	77.1	74.1
9 p. m.	62.1	64.7	69.7	65 5
Mean	63.0	66.1	70.5	66.5
RELATIVE HUMIDITY.				
7 a. m.	.87	.90	.87	.88
2 p. m.	.66	.73	.70	.70
9 p. m.	.70	.88	.83	.80
Mean	.76	.84	.80	.80
PRESSURE AS OBSERVED.				
7 a. m.	29.00	28.94	29 02	28.99
2 p. m.	28.97	28.92	29 00	28.96
9 p. m.	28.97	28.90	29.00	28.62
Mean	28.98	28.92	29.01	28.97
MILES PER HOUR OF WIND.				
7 a.m.	13.9	10.6	10.5	11.6
2 p. m	17 2	14.1	11.1	14.1
9 p. m	10.6	13.4	6.2	10.1
Total miles.	3108	2910	2630	8648
CLOUDING BY TENTHS.				
7 a. m.	6.3	7.9	7.1	7.1
2 p. m.	5.9	7.7	5.7	6.4
9 p. m.	4.3	6.0	5.3	5.2
RAIN.				
Inches	.660	1.38	1.58	3.62

HISTORICAL NOTES.

EARLY NOTICES OF THE MISSOURI RIVER AND INDIANS.

BY JOHN P. JONES, KEYTESVILLE, MO.

Probably the first white man to hear of the Missouri river was James Marquette, * the Jesuit missionary, who in the year 1669 was stationed at La Pointe, near the western extremity of Lake Superior.

This mission was visited by wandering bands of Indians from the head waters of the Mississippi and from its branches as far south as the Illinois.

From one of the Illinois Indians, Marquette learned the language of that tribe, and through him and his companions heard of the Missouri.

In a letter written in the year 1670 to Father Francis Le Mercier, the Superior of the Huron missions, after giving him such information as he had gathered con-

*Marquette was born in the province of Champagne, France, in 1637, entered the society of the Jesuits in 1654, sailed for Canada in 1666, was sent to the Ottawa Mission in 1668, and transferred to La Pointe in 1669, from there to Mackinaw in 1670, from which place he started in 1673 on the voyage of exploration down the Mississippi river, returned in September as far as Green Bay, visited the Illinois in 1675, and died on his return on the east shore of Lake Michigan, May 11th, 1665.

cerning the Mississippi river, at this date only known by report, and the Illinois Indians, to whom he was expecting to be sent as a missionary, he says:

"Six or seven days below the Illinois is another great river, on which are prodigious nations, who use wooden canoes. Of these we cannot write more till next year, if God does us the grace to lead us there."

This is the only allusion to the Missouri river that I know of as occurring in the writings of any of the western missionaries prior to the exploration of the Mississippi river.

The Illinois Indians at this time occupied territory on both side of the Mississippi, and the Missouri would be six or seven days below them. The word Missouri means canoe in the Algonquin language, and it should be born in mind that it is the name applied by Indians of that stock to our Indians, who used canoes made out of logs while their own were made of birch bark. Three years later in company with Joliet, * Marquette embarked from Mackinaw on the voyage that resulted in the exploration of the Mississippi river, and in the latter part of June, 1673, passed the mouth of the Missouri. The noble river, gorged with its annual spring rise, seemed as it poured out its mighty volume to contend with the Mississippi for the mastery, and Marquette, in his relation of the voyage, refers to it as follows: "As we were sailing gently down a beautiful still, clear water we heard the noise of a rapid into which we were about to fall; I have seen nothing more frightful; a mass of large trees entire with branches, real floating islands came rushing from the mouth of the river Pehitanoui † so impetuously that we could not without great danger expose ourselves to pass across; the agitation was so great that the water was all muddy and could not get clear. Pehitanoui is a considerable river which coming very far in the northwest empties into the Mississippi. Many towns are ranged along this river, and I hope by its means to make the discovery of the Red or California Sea."‡ The Gulf of California had been called the Red Sea by the Spaniards on account of its fancied resemblance to the Red Sea of Asia. Prior to this voyage of Marquette and Joliet the French authorities had hoped that the Mississippi would be found to empty into the Gulf of California, and by this means give them a passage to the South Sea. Marquette had now proceeded far enough to enable him to conclude that the Mississippi emptied into the Gulf of Mexico, and he, therefore, expressed the hope that the route to the Gulf of California might be found by the way of the Missouri. From 1673 to 1680 the valley of the Missis-

*Louis Joliet was born in Quebec, in 1645, joined the Jesuits at an early age, and was educated by them, became a free trader, and was noted for his acquaintance with the Indian character and languages, was named by the French authorities in 1672 to explore the Mississippi river. Made a journey to Hudson's Bay in 1679. In 1680 he received a grant of the island of Anticosti, for his services. In 1694 he explored the coast of Labrador, was made royal pilot for the St. Lawrence in 1695, and died about 1700.

†Pehitanoui is the name by which the Indians accompanying Marquette called the Missouri river. The word is probably Algonquin. The Missouri's spoke a dialect of the Dacotah language and their name for the river is unknown.

‡On June 4th, 1672, the French Minister wrote to Talon, then Intnedant of Canada, as follows: "As after the increase of the colony there is nothing more important than the discovery of a passage to the South Sea, his majesty wishes you to give it your attention."

sippi was visited only by occasional trappers and traders who left no written record of their visits. In the latter year there arrived in the Illinois country the real pioneer of the valley, René Robert Cuvelier, better known as La Salle,* which name he took from landed estates belonging to his family, who came with the intention of exploring the Mississippi to its mouth. No man has stamped his name more ineffacaebly on the pages of French-American history than La Salle. He arrived in the Illinois country in the year 1680, after enduring with his party hardship that even now seem appalling to think of, and at once set about preparing for his proposed voyage down the Mississippi. Hennepin,† one of the missionaries accompany ing him, mentions inhis "Description de La Louisanes"—Paris, 1688, the following incident as occurring at one of the Illinois viliages, and which shows that the location of the Missouri Indians was known at that early date to the missionaries and explorers. He says: "Needing Indian corn, La Salle took some and gave in return hatchets, and offered them a treaty for the exchange of those things most necessary to each, such as provisions for hatchets; however, if they would not exchange, he would go to their neighbors, the Osages, treat with them, and also leave with them a smith, who would mend their hatchets and other implements; the smith being of so much importance the Illinois consented." These Indians wishing to retain La Salle and his party with them, endeavored to dissuade them from going down the Mississippi, picturing the perils they would encounter, in such dismal colors, that many of the men were disheartened and it required all the address of their leader to prevent them from deserting in a body. As they continued on down the Illinois they met a portion of the tribe returning from a hunt, who, not knowing what had already been told by those at home, gave an entirely different account of the river below. Of this Hennepin says: "This meeting diminished in a good measure the fears of our men, and they were entirely relieved by the arrival of several Osages, Chickasaws and Arkansas, who came from the south to see the French and buy hatchets." From this it will be seen that our Missouri Indians had discovered the superiority of the French hatchets of iron over their own of stone, as had also the lower tribes who sent delegations with them. La Salle did not perfect his arrangements for the exploration of the Mississippi until February, 1682, at which time he started from the mouth of the Illinois. In the meantime the Iroquois had swept down on the Illinois villages while most of the warriors were absent on a hunt, killing a great

*La Salle was born at Rouen, France, in 1643, entered the society of the Jesuits, but left them and sailed for Canada in 1666. Discovered the Ohio river in 1669. Explored the Mississippi from the mouth of the Illinois to the Gulf of Mexico in 1582. Left France again in July, 1684, in command of an expedition for the mouth of the Mississippi, landed on the coast of Texas, and after making several attempts to reach Canada was assassinated by his own men in March, 1687, near Trinity river, Texas.

†Louis Hennepin was born in Aith, province of Hainault, entered the order of St. Francis, early developed a roving disposition, was made an army chaplain in 1674. Sailed for Canada in 1675, was stationed at Fort Frontenac in 1676. Went to the Illinois country with La Salle, and was sent by him to accompany a part of his command to explore the upper Mississippi, and was captured by the Sioux, was rescued from them in the fall of 1680. Soon after returned to Europe and published an account of his travels in 1683. He finally died in obscurity, though his book had twenty editions, in half a dozen languages, and within a year has been translated and published in this country with extensive notes.

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many and scattering the remainder. Upon the return of the warriors from their hunt, the battling was renewed, but the Illinois were finally forced to retire across the Mississippi and seek refuge among the Osages.

Father Membre,* another missionary in La Salle's party, in his narrative of "Discoveries in the Mississippi Valley," published in Le Clercq's "First Establishment of Faith in New France," Paris, 1691, mentions this as follows: "There had been several engagements with equal loss on both sides, and at last, of the seventeen villages, the greater part had retired beyond the river Colbert,† among the Osages, where a part of the Iroquois pursued them." Of La Salle's voyage down the Mississippi, the same writer gives an extended account, and mentions the Missouri as follows: "The floating ice kept us at this place till the 13th of February, when we set out and six leagues lower down found the Osage river coming from the West. It is as full as large as the river Colbert into which it empties, troubling it so that, from the mouth of the Osage the water is hardly drinkable, the Indians assure us that this river is formed by many others and that they ascend it for ten or twelve days to a mountain where it rises, that on the river are a great number of large villages of many different nations, arable and prairie lands, and abundance of cattle and beaver. Although the river is very large, the Colbert does not seem augmented by it, but it pours in so much mud that from its mouth the water of the great river is more like clear mud than river water."

After his return from the mouth of the Mississippi, La Salle conceived the project of establishing a colony of French and Indians at Fort St. Louis,‡ on the Illinois river near the Kaskaskia village. He hoped to embrace in this confederation a majority of the western tribes, and among them the Missouris. Out of the profits of their trade and the furs gathered, he expected to be remunerated for the losses he had sustained in his enterprises and which now amounted to forty thousand crowns. But while he had been contending in the valley against difficulties and obstacles calculated to dishearten the stoutest spirit, a change had been in the government of the province detrimental to his interests. Govenor Frontenac§ his friend and supporter had been recalled to France and his place supplied by Le Febre de la Barre, an old naval officer, illy fitted for the station to which he had been promoted. La Salle made an effort to secure his good will and wrote him early in 1683, expressing the hope that he should have from him the same

*Lenobious Membre, a Franciscian friar, native of Bafaume, France, arrived in Canada in 1675. Stationed at Fort Frontenace in 1678 Accompaied La Salle to the Illinois country and the Gulf of Mexico in 1862. Returned to France and sailed again with La Salle as Superior of Missionaries and landed with the colony in Texas. Was left there when La Salle started on his fatal journey and was killed with his companions at the destruction of Fort St. Louis in 1689.

†Colbert. This name was given to the Mississippi River by Joliet on his return to Canada, in honor of the French Minister of that name and was adopted by the French for a considerable period.

‡Fort St. Louis. La Salle gave this name to the post he established on the Illinois in 1680, it being on the summit of a great rock near the present village of Utica. He also gave the same name to the post he established or the coast of Texas in 1685.

§Louis de Baude, Count of of Pallua and Frontenac, was appointed govenor and arrived in Canada in 1672 was recalled in 1682.

support as from Count Frontenac, although, says he, "my enemies will try to influence you against me." He failed to secure the support of La Barre, but on the contrary, encountered his determined opposition. On the 4th of June, 1683, he wrote him regarding the future of the colony and says, "The Iroquois are again invading the country; they have lately murdered some of the Miami families and they are all in terror again. I am afraid they will take flight and so prevent the Missouris and neighboring tribes from coming to settle at St. Louis as they are about to do." Soon after this, La Salle returned to Canada and from there repaired to France. In 1684 he sailed for the Gulf of Mexico, intending to establish a colony at the mouth of the Mississippi, but by mistake landed on the coast of Texas after losing nearly all his stores. Here he built another Fort St. Louis and made several attempts to reach Canada with a portion of his command, failing, however, and was killed by one of his own men in 1687. Some of his men were successful in making their way to the Illinois country, among them Father Douay,* one of the missionaries in his party. Douay's narrative is published in Le Clercq's work previously mentioned, and in giving an account of their voyage up the Mississippi, he says: "About six leagues above this there is on the northwest, the famous river of the Massourites or Osages, at least as large as the river into which in empties. It is formed by a number of other known river everywhere navigable, and is inhabited by many populous tribes, including the Osages who have seventeen villages on a river of their name which empties into that of the Massouites to which the maps have also extended the name of the Osages. The Arkansas Indians were formerly stationed on the upper part of one these rivers, but the Iroquois drove them out by cruel wars some years ago so that they, with some Osage villages were obliged to drop down and settle on the river which now bears their name." It will be noticeable that the Missouri river is sometimes called the river of the Osages. This custom, I think, prevails mostly in the writings of the missionaries, who accompanied La Salle, and who were of the order of St. Francis, while Marquette was a Jesuit as were the greater part of all the missionaries in the West. La Salle was educated by the Jesuits, but early in his career, parted from them and became mistrustful of their intentions toward himself, so much so, that he avoided any connection with enterprises in which they took part. A jealousy also existed between the missionaries of the different orders, and to this, may be ascribed, perhaps, the use of the word Osage by the Recollects, in writing of our river, which had been called Missouri by the Jesuits. Father Douay says there is not a word of truth in the narrative of Marquett, and Le Clercq in his work, while careful not to mention his name, insinuates that his narrative has no foundation in fact.

After the assassination of La Salle in Texas, the command of the remnant of

*Anastasius Douay. But little can be learned of this priest. His visit to America with La Salle's command is the first positive information we have of him. He returned to France in safety and re-visited America in 1699 with Iberville, after which we have no record of him.

his party who were endeavoring to reach the Illinois couutry, fell on Joutel.* His journal was published in London in 1714 and in describing their course up the Mississippi, he says: "We held on the 30th and 31st and the 1st of September passed by the mouth of a river called Missouri whose water is always thick and to which our Indians did nor forget to offer sacrifices." The custom of offering sacrifices in the form of presents, to rapids and other evidences of force in nature, prevailed among several of the Indian tribes in the West. Hennepin mentions that the Sioux made offerings to the Falls of St. Anthony,† of buffalo robes, and other instances might be quoted, but at the mouth of the Missouri, some years before, a party of Miamis pursued by Mitchigamies, had been drowned and since then, Indians, in passing, throw presents into the water, in order to appease the Manitou which they suppose to dwell there. While it seemed the lot of La Salle to antagonize, in many instances, his associates in the enterprises he directed, yet he also inspired strong friendships. Among those conspicuous for devotion to his interests, was Henri de Tonty‡ one of the purest and grandest characters connnected with the exploration of the Mississippi Valley. When La Salle left the Illinois country for France, in 1683, Tonty was left in charge of his interests at Fort St. Louis. He was still there in 1687 when Joutel and his companions reached it, but they concealed from him the knowledge of the death of his commander. After hearing of La Salle's death he started in 1688 from his fort on the Illinois, intending to try and reach the Fort St. Louis on the coast of Texas and relieve the little band of Frenchmen left there by La Salle, if they were yet alive. His party, consisting of only eight persons, succeeded after great hardships, in reaching what is now the northeastern part of Texas, where discouraged, they turned back for the Illinois country. In his Memoirs, published at Paris, 1693, he says: "We arrived on the 17th of October at an Illinois village at the mouth of their river; they had just come from fighting the Osages and lost thirteen men but brought back one hundred and thirty prisoners."

On the 28th of February he arrived at the little village of Caddoquis on Red

*M. Joutel was a native of Rouen, France. He served sixteen years in the French army and on his return to his native town, found it excited over preparations for fitting out La Salle's last expedition. He volunteered and became the chief reliance of La Salle in his many adversities, and finally, on the death of the latter, his stccessor. After leading the remnant of La Salle'ss command who were trying to find the Mississippi, to ths Illinois country, he returned to France and petitioned the king to succor the colony in Texas. Failing of success, he returned to Rouen when Chalevoix visited him thirty years later.

†The principal deity of the Sioux was supposed to dwell under these falls. Jonathan Carver in his travels, etc., mentions that in 1776 he saw an Indian throw everything he had about him into the cataract as an oflering to the deity.

‡Henri de Tonti, an Italian officer and protege of Prince de Conti, who accompanied La Salle from France in 1678. He had lost one hand in the Sicilian wars and wore one of metal in the place of it. He descended the Mississippi in 1682 with La Salle, and on their return, was left at Fort St. Louis as La Salle's representative in the Illisois country, while the latter went to France In 1685 he heard that La Salle had arrived on the coast near the mouth of the Mississippi and at once descended in search of him, but not failing in his search, returned to the Fort. In 1687 he took part with DuShut in Demonville's campaign against the Iroquois. In September, 1688, he heard of La Salle's death and made an unscccessful attempt to relieve that portion of the command left in Texas. Returned to Fort St. Louis in 1689 and remained there for several years, receiving important concessions from the king in 1699 in regard to the Indian trade. He joined Iberville in lower Louisiana in 1702 and led an expidition against the Chickasaws. Nhe date of his death is unknown.

river and from his account of what transpired there it would seem that they were also at war with the Osages. After describing their reception he continues: "The next day a woman who governs this nation came to visit me with the prin- "cipal persons of the village. She wept over me, demanding revenge for the "death of her husband, and of the husband of the woman we were bringing back, "both of whom had been killed by the Osages. To take advantage of everything "I promised that the dead should be avenged." About the year 1690 Tonty petitioned the king of France to be recompensed for his services, accompaning his petition with an account of the route from the Illinois to the gulf of Mexico. In his petition he refers to the Missouri as follows: "The river of the Missouris "comes from the west and after traversing three hundred leagues arrives at a lake "which I believe to be that of the Apaches. The village of the Missourites, Oten- "tee and Osages are near one another and are situated in the prairie one hundred "and fifty leagues from the mouth of the Missouri." The above extract shows that Tonty's information concerning the country watered by the Missouri was derived from heresay and from Indians alone, as no white man had been up the Missouri at that date. It is true Baron La Hontan claimed to have ascended it in 1689 and to have spent eight days on it, but he was so given to exaggeration that I do not feel authorized to repeat what he says in regard to it. In the year 1699 the brothers Iberville and Bienville arrived in the gulf of Mexico and established a French colony near the Mississippi which eventially became the seat of French power in the whole valley. Communication was soon opened with the Illinois country; Tonty went down from Fort St. Louis as soon as he heard of the establishment of the colony and from this date most of our information concerning the Missouri country comes from sources connected with the lower settlements.

In "Penicant's Annals of Louisiana from the first establishment of the colony to 1722," the author says under date of 1700 in describing the route of an expedition to the copper mines in the country of the Sioux, "Six leagues more brought "us to the mouth of the Missouri. This river has a very rapid current especially "in the spring of the year when the waters are high; in passing beyond the islands "which it inundates it roots up the trees, and drags them along in its course, and "it is from this cause that the Mississippi is filled with floating trees. It also as- "sumes its color from this river, neither source of which has ever been discover- "ed, I will not speak of the Indians dwelling on the banks of the Missouri because we have never ascended it."

In the year 1699 St. Cosme,* a missionary priest from Canada, descended the Mississippi and in a letter describing his trip refers to the Missouri as follows: "On the 6th of December we embarked on the Mississippi; after making about "six hundred leagues we found the great river of the Missouris which comes from "the west and which is so muddy that it spoils the waters of the Mississippi which "down to this are clear. It is said that up this river are a great number of Indi-

*John Francis Buison, born in Canada 1667, educated for a Jesuit Priest and ordrined in 1690. Went to Natches as a Jesuit missionary in 1700. Was killed by the Indians in 1707 while descending the Mississippi.

"ans." At another place he mentions a meeting with the Arkansas and says: "We told them we were going further down to their neighbors and friends, that "they would see us often, that they would do well to assemble all together, so as "more easily to resist their enemies. They agreed to all and promised to try and "make the Osages join them, who had left the river of the Missouris and were on "the upper waters of their river." In the year 1700 M. Le Seuer, a Canadian and kinsman of Iberville, was sent to establish a post at the source of the Mississippi and in his narrative of the voyage he refers to the Missouri as follows: "The Sioux generally keep to the prairies between the upper Mississippi and the "river of the Missouris and live solely by hunting." At another place he says: "We ascertained that the Ayavoes and Octoctatas* had gone to station themselves "on the side of the river of the Missouri in the neighborhood of the Maha, a na- "tion dwelling in those quarters." Under the date of 1702 he refers to a meeting he had with some Canadians as follows: "Having gone six leagues and a quar- "ter I halted at the mouth of the Missouri river and met here three Canadian trav- "elers who were coming to join my company. I received by them a letter from "Father Marest, of the Mission of the Immaculate Conception in Illinois, warning "me that the Languetas had been defeated by the Sioux and Ayavoes and had "joined with a part of the Mecoutins,† Foxes and Mitsigamias to avenge them selves, not upon the Sioux, for they fear them too much, possibly upon the Aya- voes, perhaps on the Paonties‡, or more likely upon the Osages, for these mistrust nothing and the others are upon their guard.

Father Gravier, one of the most prominent of the early missionaries of the west, in writing of a voyage that he made down the Mississippi in 1700 says: "The Arkansas river runs northwest, and by ascending it they go to reach the river of the Missouris by making a portage." This portage could be made between the branches of these rivers, but not the main streams. As most of the traveling in those days was made with canoes, it was essential to have a knowledge of the crossings or portages. Father Gabriel Marest, in a letter from Kaskaskia dated Nov. 9th, 1712, says: "Seven leagues below the mouth of the Illinois river is found a large river named Missouri, or more commonly the 'Pektanoni,' that is to say 'muddy water,' which empties into the Mississippi from the west side. It is extremely rapid and soils the beautiful waters of the Mississippi, which run from there to the sea. It comes from the northwest very near the mines which the Spanish have in Mexico, and is very convenient to the French who travel in that country." In another place he says, "We are but thirty leagues from the Missouri or Pektanoni. This is a large river which flows into the Mississippi, and they pretend that it comes from a still greater distance than that river. It is up on the Missouri river that the Spaniards have their best mine."

*Iowas and Otoes.

†This tribe of Indians early disappeared. They were generally known as the Fire Nation. At the time of the first exploration of the west by the French, their home was west of Lake Michigan, in what would now be the State of Wisconsin.

‡Pah Utah—now Ute.

It will be seen that the Spanish mines in New Mexico were attracting the attention of the Jesuits, who advised their superiors of any and everything that could possible be of interest or benefit to their order. Father Charlevoix, in one of his letters to the Duchess of Les De Guireres,* dated at Kaskaskia, Oct. 20, 1721, has the following relative to the Missouri and Osages. "The Osages, a pretty numerous nation, settled on the side of a river that bears their name and which runs into the Missouri about forty leagues from its junction with the Mississippi, send once or twice a year to dance the calumet amongst the Kaskaskias, and are actually here at present. I have also just now seen a Missouri woman who told me that her nation is the first we meet with going up the Missouri, from which she has the name we have given her for want of knowing her true name. It is situated eighty leagues from the confluence of that river with the Mississippi. This woman has confirmed to me what I heard from the Sioux, that the Missouri rises out of some naked mountains, very high behind which there is a great river which probably rises from them also and which runs to the west. This testimony carries some weight, because of all the Indians we know none travel further than the Missourites." This great river that runs to the west, and of which he heard from the Sioux and Missouris both, was undoubtedly the Columbia, and the fact that it was known to the Missouris is an evidence that they were indeed great travelers, and this was true of many of the Indian tribes. The Osages rambled to Texas on the south, New Mexico on the west and Lake Michigan on the northeast. The New England Indians who were dispersed in the King Philip war were for a time located in Northern Illinois. La Salle had with him Indians from Maine. The Shawnees at different times were located in what are now the states of Pennsylvania, South Carolina, Kentucky, Ohio and Illinois, and other instances could be quoted if space would permit. The question of a route to the Pacific Ocean was at this time agitating the minds of many of the enterprising French located at Kaskaskia, and several "reports" were made to the home government setting forth the feasibility of a route by way of the Missouri. Father Charlevoix suggests the exploration of the river as follows: "I can make no doubt on weighing the information I have had from many places and which agree pretty well together, that by endeavoring to penetrate to the source of the Missouri one would find wherewithal to make amends for the charges and fatigues of such an enterprise." Of the Missouri and Mississippi the same writer says: "After we had gone five leagues on the Mississippi we arrived at the mouth of the Missouri, which runs north, northwest and south, southeast. I believe this is the finest confluence in the world. The two rivers are much the same breadth, each about half a league, but the Missouri is by far the most rapid and seems to enter the Mississippi like a conqueror, through which it carries its white waters to the opposite shore without mixing them, afterward it gives its color to the Mississippi, which it never loses again, but carries it qu.te down to the sea."

*Journal of a voyage to North America, undertaken by order of the French King, translated from the French, London, 1761.

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NOTES AND QUERIES.

CHARITON.

In the map that accompanies the copy of Lewis and Clark that I have, Chariton is laid down as Charlatan, but in the text it is given as stated by Mr. Broadhead. Perrin DuLac, who ascended the Missouri river in 1802, gives in his "Voyage to Louisiane," published at Paris, 1805, an elaborate map of that river and its branches, on which the Chariton is laid down as Grand and Little Charleton. Brown's *Western Gazetteer*, published at Auburn, N. Y., 1817, has the name Charlatan. Breckenridge, in his "Views of Louisiana," published at Pittsburgh, Pa., 1814, calls it Charlatan and Chareton. Breckenridge ascended the Missouri in 1811. J.

What is the origin of the name of the Ozark Mountains? C. D.

In the early part of the present century, there was a fort on the Missouri river, between the Grand river and mouth of the Kansas, called Fort Osage, afterward changed to Fort Clark. Can any one tell me were it was situated?

OSAGE.

In the year 1797, a Welshman named Evans and an American named Mackay, ascended the Missouri river for several hundred miles and spent two years exploring the country. Was there ever any account (even if short) of their travels published; if so, where can it be found? AYTIQUARY.

The Otoes and Missouris claimed, during the war of 1812 with Great Britain, that Tecumseh sent them a belt, inviting them to join his confederation against the Americans. Is there any confirmation of this? OTOE.

MEDICINE AND HYGIENE.

PREVENTION OF DIPHTHERIA.

BY EDWIN R. MAXSON, A. M., M. D., LL.D.

To prevent diphtheria, and so finally exterminate it, every man, woman, and child, throughout our land and the world should be brought to obey the laws of life and health.

Parents should regularly feed, properly clothe, and duly restrain all children, before they come to the years of understanding and accountability. This alone would do much. A late prominent physician of Paris estimated that 3,000

children had died in that city, during the thirty years of his practice there, from short sleeves, short pants, and other kindred imprudence in the dressing of children. And I am fully convinced that as large a proportion are sacrificed, in towns at least, in this country, from the same cause—all for a *wicked* fashion. And from careful observation in this country and abroad, I am confident that at least as many more are carried off by improper food and irregularity in taking it, together with poisonous candies and other unwholesome and indigestible trash, that no child or person should eat.

Many of these, it is true, do not die of diphtheria. But it should be remembered that all this goes to predispose those not actually killed by depraving the blood and lessening the powers of vital resistance. And hence, when exposed to the *contagion* of diphtheria, or to putrid animal and vegetable exhalations, they are the first to take and most liable to die of it.

Children on attaining the age of accountability, and all other persons, should take plain, nourishing, and digestible food, with strict regularity, and nothing between meals or late at night. Trash, tobacco, intoxicating drinks, cosmetics, hair dyes, dime novels, etc., should be avoided by all. And while the amount of clothing should not be in excess, care should be taken to keep the arms, legs, and feet well protected, and all dress should be adapted to the season.

The person should be kept *clean*, without too much fretting of the skin by unnecessary washing, lest the urinary or other excretions should be called to the surface, thereby increasing personal filth, and injuriously deranging the various functions of the body. Sleeping rooms should be as far from the ground as possible; water should not be allowed in cellars, for a day even; and no decaying vegetables should be kept there.

Pure air should be allowed to pass into, and foul air out of, sleeping and all other rooms, without admitting dampness, or exposing the occupants to chilly night air more than can be helped.

No stagnant water should be allowed about a dwelling. And the back yards, where children play, should be kept exquisitely clean. Drains for sinks should be kept in order; and privy vaults should be cleaned out as often as twice a year, lime thrown in at least once a week, and if convenient, dry earth each day.

Heaps of filth should never be allowed about barns or out-houses. Hen coops, pig-sties, and rabbits' cages, if allowed, should be as far from the house as possible, and kept exquisitely clean; and no water should be used that could possibly contain decaying animal and vegetable matter.

Children should not be put to such kinds of labor as would expose them to injuries from filth, damp air, or other injurious influences. And adults should avoid such exposures as far as possible.

Now, as it was a deviation from all these rules of propriety which has predisposed to and kept up diphtheria, and all other kindred diseases, it is only by a return to these laws of health and rules of propriety, in every minute particular, that they are to be prevented and exterminated. And, while all this cannot be

accomplished at once, very much can be done *now*, and more ultimately, by getting right in all these particulars. And public hygiene, carrying out these principles in ample drainage, supplying pure water, cleaning streets, and suppressing all nuisances, may aid greatly in this work. And when a generation shall have been raised up with such habits and without the hereditary predisposition to this and other kindred diseases, children not inheriting it, properly cared for by their parents and obeying all the laws of life and health, may become in a great degree secure from the ravages of diphtheria, and hence of other putrid diseases. And as the body is the instrument of the mind, physical disease may not only be eradicated in the main, but the intellectual and moral powers of mankind will become proportionally elevated; and thus humanity may in a measure approximate Divinity, and become more nearly "allied to angels on the better side." Let us labor for this, then, as not only involving the *physical*, but also in an equal degree, the *intellectual and moral well-being of mankind*

BOOK NOTICES.

THE YOUNG FOLKS' CYCLOPÆDIA OF PERSONS AND PLACES, BY JOHN D. CHAPLIN, Jr., pp 936, 8vo; New York; Henry Holt & Co.; $3.50; for sale by M. H. Dickinson.

The success of "The Folks' Clyclopedia of Common Things," by the same author, encouraged him to undertake the book under consideration, which is devoted to accounts, written in a style readily comprehensible by children, of noted persons and places, both real and fabulous, thus supplementing the first, which was devoted to things in nature, science and art. Everything has been done in the way of illustration, description, pronunciation of words, etc., to make this work a most valuable one for school children and families, and in our judgment the effort has been far more than ordinarily successful. In looking through its pages we are surprised to note the amount of labor that has been bestowed upon it in collecting from all reliable sources, interesting and valuable information upon all possible subjects, historical, geographical and biographical. Teachers who can induce their scholars to purchase this book, will save themselves great labor and will contribute largely to the information as well as pleasure of their pupils.

ODONTORNITHES; A MONOGRAPH ON THE EXTINCT TOOTHED-BIRDS OF NORTH America, by Othniel Charles Marsh; 4to, pp. 201; Illustrated; Washington, Government Printing Office, 1880.

The fact, that by far the most numerous and perfect bird fossils have been discovered in the cretaceous beds of Kansas and Colorado, renders this magnifi-

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cent work the more interesting and valuable to the geologist of the West. Professor Marsh, who is among the first palænotologists of the present day, has spent the past ten years investigating this subject, much of the time in the field, associated with the local scientists, many of whom, like Mudge, Snow, St. John, Williston and others, have contributed all in their power to his success in searching out, discovering and classifying these wonderful remains.

The field is but comparatively unexplored, the material already discovered is sufficient for years of study and several volumes of description, while the results already attained, as Prof. Marsh observes, are full of promise for the future. This not only applies to fossil birds, but to gigantic reptiles and vertebrata of all kinds, including the first remains of Primates found in North America, also the first Cheiroptera, Marsupiala and Tillodontia.

This volume is devoted mainly to descriptions of the Toothed Fossil Birds, *Hesperornis*, which were very large swimming birds without wings and with teeth in grooves, and another group, endowed with great powers of flight and having the teeth in sockets and bi-concave vertebræ, best illustrated by the genus *Ichthyornis*. The illustrations consist of thirty-four plates and forty wood cuts, executed in the finest style of the engraver's art.

Professor Marsh has prepared a synopsis of this work with some of the most striking illustrations, which we hope to secure for publication in the REVIEW as a matter of special, and comparatively local, interest to our subscribers in the region in which these remarkable creatures and their no less remarkable associates once lived and flourished.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE FOR 1879–80; Edited by the Secretary; Vol. VII; Topeka, Kansas; Geo. W. Martin; 1881.

This Academy maintains its work of investigating and exploring the geological, meteorological, archæological and geological conditions of its own State with unusual zeal and energy. The Professors of the State University, the Agricultural College, the Normal Schools and of Washburn College, Baker University and other literary institutions of Kansas, have, by common consent, united in their efforts to keep up the Academy and to make its work thorough and comprehensive. In the present volume are found over thirty papers, embracing seven articles upon geology and mineralogy, nine on zoölogy, three on meteorology, four on archæology and palæontology, two on botany, one on color blindness, one on irrigation, one on chemical apparatus, one on education, one memorial essay; also lectures by Prof. Geo. T. Fairchild, of State Agricultural College, and Prof. J. T. Lovewell, of Washburn College, and a description of the Aztec Ruins of the Pecos Pueblo in New Mexico, by Theo. S. Case.

The work consists of one hundred and thirty-six pages and is well arranged and indexed. It will be found of decided value to all interested in the remote past, as well as the present natural history of Kansas.

THE HYGIENE AND TREATMENT OF CATARRH, BY THOS. H. RUMBOLD, M. D.; 12mo; pp. 174; St. Louis, Mo.; 1880.

Dr. Rumbold has devoted many years to the study of catarrh and is as fully competent to discuss it as any physician in the country. In the volume above named, he mainly treats of this disease from a hygienic standpoint, giving rules and instructions for its avoidance and prevention, which, if observed, will certainly prove efficacious. We fully agree with the Arkansas *Medical Monthly*, that "it is a well written, concise and practical work, embracing a careful study of all the conditions which are liable to produce the diseases of which it treats. The relations which bad colds, bad teeth, clothing, head-wraps, bathing, exercise, diet, stimulants and use of tobacco bear toward the disease in question, are minutely considered. This is not only a good book for the specialist, and general practitioner, but one which they should advise the laity to purchase and study, that they may learn how to protect themselves from these too common affections."

OTHER PUBLICATIONS RECEIVED.

Bulletin of the Essex Institute, Salem, Mass., Oct., Nov. and Dec., 1880, Vol. XII.—Rogers' Birds Eye View of English Language, a chart 22x28 inches with rules for spelling, punctuation, use of capital letters, etc.; L. H. Rogers, New York, 25 cents.—Index to Papers on Anthropology, published by the Smithsonian Institution, 1847 to 1878, by Geo. H. Boehmer.—The Mississippi River and What its Proper Utilization will Accomplish; Toledo, O., 1881.—Library Aids, by Hon. John Eaton, Commissioner of Education, Washington, D. C., 1881.—On the Projection of Lines of Equal Pressure in the United States West of the Mississippi River, by Henry A. Hazen, 1881.—Abstract of Transactions of the Anthropological Society of Washington, D. C., with the Annual Addresses for 1880 and 1881. Edited by J. W. Powell. 1881.

SCIENTIFIC MISCELLANY.

GLASS SPINNING AND WEAVING.

Quite recently a glass firm in Pittsburg, United States, has succeeded to a notable degree, in producing glass threads of sufficient fineness and elasticity to permit of their being woven into fabrics of novel character and quality. Their success is such as to warrant the assumption that garments of pure glass, glistening and imperishable, are among the possibilities of the near future. The spinning of glass threads of extreme fineness is not a new process, but as carried on at present by the firm in question—Messrs. Atterbury & Co.—possesses consid-

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erable interest. From a quality of glass similar to that from which table-ware is made, rods of glass, averaging half an inch in diameter, are drawn to any desired length and of various colors. These rods are then so placed that the flame of two gas burners is blown against that end of the rod pointed toward the large "spinning" wheel. The latter is 8½ feet in diameter, and turns at the rate of 300 revolutions per minute. The flames having played upon the end of the glass cylinder until a melting heat is attained, a thread of glass is drawn from the rod and affixed to the periphery of the wheel, whose face is about twelve inches wide. Motion is then communicated, and the crystal thread is drawn from between the gas jets and wrapped upon the wheel at the rate of 7,500 feet per minute. A higher speed results in a finer filament of glass, and *vice versa.* During its passage from the flame to the wheel, a distance of five or six feet, the thread has become cooled, and yet its elasticity is preserved to a n table degree. The next step in the process consists in the removal of the layers of threads from the wheel. This is easily accomplished, and after being cut to the desired lengths, the filaments are woven in a loom somewhat similar to that used in weaving silken goods. Until within the past few weeks only the woof of the fabric was of glass, but at present both warp and woof are in crystal. Samples of this cloth have been forwarded to New York and Chicago, and the manufacturers claim to be able to duplicate in colors, textures, &c., any garments sent them. A tablecloth of glass recently completed, shines with a satiny, opalescent luster by day, and under gas light shows remarkable beauty. Imitation plumes in opal, ruby, pale green and other hues, are also constructed of these threads and are wonderfully pretty. The chief obstacle yet to surmount seems to lie in the manipulation of these threads, which are so fine that a bunch containing 250 is not so thick as an average sized knitting needle, and which do not possess the tractability of threads of silk or cotton.

The weaving of such heavy fabrics of glass for ornamental purposes and for curiosities is no new thing, nor, in our estimation, does comparative success in such experiments warrant the enthusiastic claims of the Pittsburg manufacturers touching the adaptability of glass for wearing apparel. Unless it is in their power to change the nature of glass absolutely and radically, it does not seem possible for them to overcome the ultimate brittleness of the separate fibers as to make the fabric fit to be brought in contact with the skin. The woven stuff may be relatively tough and flexible, but unless the entire fabric can be made of one unbreakable fiber, the touch of the free ends, be they ever so fine, must be anything but pleasant or beneficial, if one can judge by the finest filaments of glass spun hitherto. Besides in weaving and wearing the goods a certain amount of fiber dust must be produced as in the case of all other textile material. When the softest of vegetable fibers are employed the air charged with their fragments is hurtful to the lungs, still more injurious must be the spiculæ of spun glass.

However, although the manufacturers are likely to be disappointed in their expectations of finding in glass a cheap and available substitute for linen, cotton, or silk in dress goods, it is quite possible that a wide range of useful application may be found for their new fabric.—*Journal of Applied Science.*

USES OF SAWDUST.

In most of our large cities, this material is not wasted, but has a commercial value and is eagerly sought after by parties who vend it. In New York this is notably the case. It is said that there are as many as 500 sawdust venders in this city. Years ago the mills were glad to have their sawdust removed; but since then there has been a growing demand for it, and the average price paid for it by the venders is about $3.50 per load. Special machines have been patented for grinding up shavings into coarse dust, which is prepared by some of the large mills for sale to the venders.

It is sold in large quantities to hotels, eating houses, saloons, groceries and other business houses.

It is moistened with water and strewn on the floors, where it serves the useful purpose of laying the dust, and makes sweeping up cleaner work. Plumbers use it constantly about their pipes; and builders to deaden walls and floors. Soda water men and packers of glass, china and other fragile wares, use it in considerable quantity. The markets and stables use considerable.

Yellow Pine makes the most desirable material for these uses; it is less dusty than other varities, and has besides a pleasant aromatic odor. But the dust of any of the white wood is indiscriminately used. Walnut dust is not in demand for these uses, and where it is possible to do so, it is burned.

It is estimated that there is capital of about $200,000 invested in the business of vending sawdust in this city. The quantity disposed of in the manner above described must therefore be immense.—*The Manufacturer and Builder.*

DISCOVERIES BY ACCIDENT.

Valuable discoveries have been made and valuable inventions suggested by the veriest accidents. An alchemist, while seeking to discover a mixture of earths that would make the most durable crucibles, one day found that he had made porcelain. The power of lenses, as applied to the telescope, was discovered by a watchmaker's apprentice. While holding spectacle-glasses between his thumb and finger, he was startled at the suddenly enlarged appearance of a neighboring church spire. The art of etching upon glass was discovered by a Nuremberg glass cutter. By accident a few drops of aqua fortis fell upon his spectacles. He noticed that the glass became corroded and softened where the acid had touched it. That was hint enough. He drew figures upon glass with varnish, applied the corroding fluid, then cut away the glass around the drawing. When the varnish was removed the figures appeared raised upon a dark ground. Mezzotinto owed its invention to the simple accident of the gun barrel of a sentry becoming rusted with dew. The swaying to and fro of a chandelier in a cathedral suggested to Galileo the application of the pendulum. The art of lithographing was perfected through suggestions made by accident. A poor musician was curious to know

whether music could not be etched upon stone as well as upon copper. After he had prepared his slab his mother asked him to make a memorandum of such clothes as she proposed to send away to be washed. Not having pen, ink and paper convenient he wrote the list on the stone with the etching preparation, intending to make a copy of it at leisure. A few days later, when about to clean the stone, he wondered what effect aqua fortis would have upon it. He applied the acid and in a few minutes saw the writing standing out in relief. The next step was simply to ink the stone and take off an impression. The composition of which printing rollers are made was discovered by a Salopian printer. Not being able to find the pelt-ball he inked the type with a piece of soft glue which had fallen out of a glue pot. It was such an excellent substitute that, after mixing molasses with the glue to give the mass proper consistency, the old pelt-ball was entirely discarded. The shop of a Dublin tobacconist by the name of Lundy was destroyed by fire. While he was gazing dolefully into the smoldering ruins he noticed that his poorer neighbors were gathering the snuff from the canisters. He tested the snuff for himself, and discovered that the fire had largely improved its pungency aroma. It was a hint worth profiting by. He secured another shop, built a lot of ovens, subjected the snuff to a heating process, gave the brand a particular name and in a few years became rich through an accident which he at first thought had completely ruined him.—*The Age of Steel.*

IRON AND WOODEN SHIPBUILDING.

The position of iron shipbuilding in this country, although limited, virtually, to a few establishments on the Delaware, is by no means so trifling as many newspapers would have their readers suppose. All well-equipped iron ship yards are full of orders, and there is every reason to believe they are doing a profitable business. An oft-repeated assertion, that large iron vessels cannot be constructed in this country with both pecuniary and mechanical success, is entirely unfounded. The high cost of labor and materials, as compared with their price in England, can be offset by the same ability and surpassing enterprise that enables our manufacturers to compete so favorably with British goods in foreign markets. Yet the advantages for building iron ships, in competition with the English, are somewhat different from those possessed by manufacturers of articles for stationary use. Our ocean-carrying trade can be, and mostly is, done in foreign bottoms, but our internal industries cannot be under foreign control—at least while a protective tariff remains in force.

As iron and steel for constructing, and steam for propelling vessels are rapidly superseding wooden-built and wind-power-driven ships, there would seem to be some good openings for ambitious capitalists and business men to start a few iron shipyards in the vicinity of New York City. We are credibly informed that there are now eighty iron steamships on the stocks in course of construction in Scotland, none of which are less than 3,000 tons burden, besides a great many others of

smaller capacity. All the large shipbuilding establishments in Great Britain seem to be full of work. On the other hand, the building of wooden vessels in Maine has been steadily declining. During the year 1880 ninety-two vessels, with an aggregate tonnage of only 35,847, were built in the state. This was less than half the tonnage of 1877, since which there has been a decline every year. It is useless to try to bolster up such an industry in the face of the much greater favor with which iron vessels are regarded. We should not be so far behind our British cousins in this very important industry. There is a growing demand for iron river and excursion boats, which alone will sustain several shipyards.—*American Machinist.*

EDITORIAL NOTES.

THE reception which the first number of the fifth volume of the REVIEW, in its improved form, has met with is very encouraging and flattering to its editor, but the publisher's department suggests that such improvements cost a good deal of money, and that a hundred more subscribers would be exceedingly welcome.

THE meeting of the Missouri Press Association for the year 1881, was a memorable one for many reasons, but principally, aside from the instruction and entertaining exercises of the meeting itself, on account of the hospitality of the people of Jefferson City; the excessive courtesy of the Chicago and Alton Railroad Co., through its officers Mr. Charlton and Mr. Bowes; the polite attention of Mr. Palmer, of the Palmer House, Chicago; the liberal concessions of the Pittsburg and Ft. Wayne Railroad, through Mr. Ford and Mr. Adams; the urbanity of Capt. Blake, of the Mt. Vernon steamer "Corcoran," and finally. the unwearying good offices of Senators Cockrell and Vest, and Messrs. Burdett, Clements and Morrow at Washington City.

Everything was promptly and cheerfully done to make the excursion pleasant, and every effort was eminently successful.

THE commencment exercises at the Kansas State University will be held from June 3d to June 8th, and will undoubtedly prove of great interest to such of our readers as may attend.

THE local gas company, accepting as a challenge the admiration evoked by the Swan electric lamps, at present lighting the thoroughfares of Newcastle, England, recently placed at the corner of one of the streets, in close contiguity to the electric light, one of Bray's three-light lamps. The lamp was obscured at the top, and the effect is described as very striking, its illuminating power being pronounced excellent. The advocates of gas-lighting claimed a victory for the old over the new mode and power of illumination.

THE *Review* is well appreciated by western readers and we are glad to see that it is receiving flattering recognition from some of the ablest eastern journals and is favorably known to scientists in England. The *Review* is the only periodical of its practical character in the West, and under Mr. Case's careful and excellent management, is a feature of our literature that we are all proud of.—*Topeka Capitol.*

THE Mineral Springs of Clay county, this State, are attracting a great deal of attention just now. We shall visit some of them soon and report through the columns of the REVIEW.

THE fifth volume of *The Kansas City Review of Science and Industry* was begun with the May number. This publication is a popular one, comprising articles by the best writers, and selections from the best periodicals in this country and in Europe, upon geology, mining, medicine, hygiene, explorations, travels, biography, etc. Every number is almost a library in itself. Theo. S. Case, the editor of the *The Review*, is one of the best known writers in the West.—*Leavenworth Times.*

THE Kansas State Teachers' Association meets at Manhattan, June 21, 1881. Among other prominent teachers "billed," we notice the name of Prof. J M. Greenwood, of this city. The occasion will doubtless be full of interest and profit to all attending.

CAPT. J. M. TROWBRIDGE, C. E., informs us that the narrow track railway described in the last issue of the REVIEW, is two feet gauge instead of ten inches. We presume he is correct, although the item was received from a reputable source.

THE *Kansas City Review of Science and Industry*, edited by Theodore S. Case, is a border monthly which will compare very favorably with periodicals of its class publishe l nearer old world centers. It obviously has an intelligent local support, and deserves to be better known in other quarters.—*Cincinnati Gazette.*

OUR Ellsworth contributor, Chas. H. Sternberg, is now in western Kansas collecting fossil specimens. He has already sent several new species to Professors Lesqureux and Agassiz. We hope to publish some of the results of his work to the July REVIEW.

THE May number of the *Kansas City Review of Science and Industry* is the commencement of volume five. We are glad to see the size of the page somewhat increased, while the matter is kept fully up to the standard. One of the best publications in the country. —*Boston Journal of Commerce.*

THE annual meeting of the Missouri State Teachers' Association will take place at Sweet Springs, (Brownsville) Mo. It will begin on the evening of Tuesday, June 21st, and continue through the 22d, 23d and 24th. Every friend of education is requested to further, by his presence, the objects of the Association.

COMMANDER COOPER, commanding the United States Steamer Alliance, now at Norfolk, Va., has been ordered to prepare his ship with all dispatch to proceed on a cruise in search of the Jeannette, between Greenland, Iceland and the coast of Norway, and as far as the northern coast of Spitzberger, if it is possible to get there without endangering the vessel.

WE learn from the official report that Kansas City is the 30th city in point of size in the United States, the 16th in the number of letters mailed, and the 3d, including Washington City, in the average number mailed by each person during the year 1880. The actual number of letters mailed was 5,706,227, or 102.23 for each inhabitant.

THE reports from Atlantic vessels show that the number of icebergs and the amount of ice floes in the ordinary path of commerce is greater at present than ever before at this season of the year.

THE *Review* is, aside from general science, a local publication, and gives not only facts and information of local interest, but its science is Western, and its articles sufficiently practical to make it racy of the soil. Missouri, Kansas, Colorado, New Mexico and the West furnish the topics and, what is better, the writers; and its information is nowhere else obtainable. And we know if the intelligent people of the city and the country around generally knew the importance of its contents and the good work it has done and is doing for our soil, climate, mines and general interests, the enterprising publisher would be a great deal better rewarded than he is, proud as he is to be able to keep it alive. It is a treasure to any intelligent Western man.—*Kansas City Journal.*

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